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Co-management and Rights-based Approaches: the role of governance and tenure in the Striped venus (*Chamelea gallina*) clam fishery of the gulf of Cádiz

JUAN FRANCISCO LECHUGA SÁNCHEZ
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Universidad de Alicante

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CIHEAM
Instituto Agronómico Mediterráneo de Zaragoza

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Trabajo realizado en la Organización de las Naciones Unidas para la Alimentación y la Agricultura en Roma, bajo la dirección de la Doctora Rebecca Metzner.

Y presentado como requisito parcial para la obtención del Diploma Master of Science en Gestión Pesquera Sostenible otorgado por la Universidad de Alicante a través de Facultad de Ciencias y el Centro Internacional de Altos Estudios Agronómicos Mediterráneos (CIHEAM) a través del Instituto Agronómico Mediterráneo de Zaragoza (IAMZ).

Vº Bº Director

Fdo: Dña. Rebecca Metzner.

Autor

Fdo: D. Juan Fco Lechuga Sánchez a 04 de Septiembre de 2017

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- José Luis SÁNCHEZ LIZASO, Presidente.
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Abstract

This study analyses the Andalusian coastal governance, with special emphasis on the cofradía co-management system, and the distribution of rights in the Striped venus clam (*Chamelea gallina*) fishery in a case study focused on the fleets of mechanized dredge in the gulf of Cádiz, south-western Spain. The objective is to evaluate if the coastal Andalusian governance and the distribution of fishing rights are contributing or not to the sustainability of the fishery of Striped venus. The governance assessment tool developed by the Environmental Defense Fund (EDF) has been used for analysis if the attributes of the coastal governance are contribution to the sustainability of the fishery. Also, the effect of the fishing right over fishermen individual behaviour has been estimated using the property rights´ economic characteristics assessment, combining methodologies used by the Organisation for Economic Co-operation and Development (OECD) and the European Commission (EC). The results shows that lack of cohesion self-organization and cooperation between the cofradías of the gulf of Cádiz, additionally to a poor enforcement, are making the cofradía co-management system ineffective. Moreover, no real fishing communal rights re in place and the individual fishing license system has low exclusivity. Additionally, the security provided by the right can also be threatened due to the ineffective co-management and enforcement. This general weakness of property right can be leading the fishers to act in a non-sustainable way.

Key words: governance, co-management, rights, sustainability.

Resumen

Este estudio analiza la gobernanza costera andaluza, haciendo especial hincapié en el sistema de co-gestión con las cofradías, así como la distribución de derechos de pesca en la pesquería de chirla (*Chamelea gallina*) en un caso de estudio centrado en las flotas de draga hidráulica en el golfo de Cádiz, situado al sur-oeste de España. El objetivo es evaluar si la gobernanza costera andaluza y la distribución de derechos de pesca están contribuyendo a la sostenibilidad de la pesca de chirla. La herramienta de evaluación de gobernanza desarrollada por el Environmental Defense Fund (EDF) ha sido utilizada para analizar si los atributos de la gobernanza costera española están contribuyendo a la sostenibilidad de la pesca. A su vez, los efectos de los derechos de pesca sobre el comportamiento individual de los pescadores se ha estimado mediante la evaluación de las características económicas de los derechos de propiedad, combinando metodologías utilizadas por la Organización para la Cooperación y el Desarrollo Económicos (OCDE) y de la Comisión Europea (CE). Los resultados muestran que la falta de cohesión, auto-organización y cooperación entre las cofradías del golfo de Cádiz, así como el la dificultad a la hora de hacer cumplir la legislación vigente, han llevado a un sistema de cogestión con las cofradías ineficiente. Además, no hay verdaderos derechos de pesca por comunidad y el sistema individual de licencias de pesca tiene una baja exclusividad. A eso hay que sumarle que la seguridad que proporcionan los derechos de pesca puede estar siendo amenazada por la ineficiencia de la cogestión y el bajo cumplimiento de la legislación. La debilidad general de los derechos de pesca puede estar haciendo que los pescadores se comporten de forma poco sostenible.

Palabras clave: gobernanza, cogestión, derechos, sostenibilidad.

Résumé

Cette étude analyse la gouvernance côtière andalouse, en mettant l'accent sur le système de cogestion avec les *cofradías*, ainsi que la distribution des droits de pêche dans la pêcherie de Petite praire (*Chamelea gallina*) dans un cas d'étude qui se concentre sur les flottes de drague mécanisée du golfe de Cadix, au sud-ouest de l'Espagne. L'objectif de cette étude est de déterminer si la gouvernance côtière espagnole et la distribution des droits de pêche contribuent à la durabilité de la pêcherie de Striped venus. L'outil d'évaluation de la gouvernance développé par l´Environmental Defense Fund (EDF) a été utilisé pour analyser si les attributs de la gouvernance côtière espagnole participent à la durabilité de la pêcherie. Par ailleurs, les effets des droits de pêche sur le comportement individuel des pêcheurs ont été estimés à travers l'évaluation des caractéristiques économiques des droits de propriété, en associant les méthodologies utilisées par l´Organisation de Coopération et de Développement Économiques (OCDE) et par la Commission Européenne (CE). Les résultats montrent que le manque de cohésion, d´autorégulation et de coopération entre les *cofradías* du golfe de Cadix, ainsi que la difficulté lors de l´application de la réglementation en vigueur, ont abouti à un système de cogestion avec les *cofradías* inefficace. De plus, il n'existe pas de vrais droits de pêche par communauté et le système individuel de licence de pêche est peu exclusif. En outre, la sécurité garantie par les droits de pêche peut être menacée par l'inefficacité de la cogestion et par la non-application de la loi. La faiblesse généralisée des droits de pêche peut inciter les pêcheurs à adopter un comportement peu durable.

Mots-Clés: gouvernance, cogestion, droits, soutenabilité.

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List of abbreviations

AGAPA	Agencia de Gestión Agraria y Pesquera de Andalucía - Agrarian and Fishery Management Agency of Andalusia
BOJA	Boletín Oficial de la Junta de Andalucía - Official Andalusian Government Gazette
CAPDR	Consejería de Agricultura, Pesca y Desarrollo Rural - Ministry of Agriculture, Fisheries and Rural Development
CFP	Common Fisheries Policy
COS	Center of Oceans Solution
CPUE	Catch per Unit Effort
CQ	Community-based catch quotas
EC	European Commission
EDF	Environmental Defense Fund
EU	European Union
FACOPE	Federación Andaluza de Cofradías de Pescadores - Andalusian Federation of fishers' Guilds -
FAO	Food and Agriculture Organization
FNCP	Federación Nacional de Cofradías de Pescadores - Nacional Federation of Fishers' Guilds
GPS	Global Positioning System
GRT	Gross Register Tonnage
ICES	International Council for the Exploration of the Sea
IE	Individual effort quotas
IEO	Instituto Español de Oceanografía - Spanish Institute of Oceanography
IQ	Individual quotas
JJAA	Junta de Andalucía - Governmental body of the Autonomous Region of Andalucía
LDPMDE	the Ley 3/2001 del 26 de Marzo de Pesca Maritima del Estado - State Marine Fisheries Law 3/2001 of the 26th of March
LL	Limited Licenses
MAPAMA	Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente - Ministry of Agriculture and Fisheries, Food and Environment
MSY	Maximum Sustainable Yield
OECD	Organisation for Economic Co-operation and Development
RBA	Rights-based Approach
SLSEPA	Sistema de Localización y Seguimiento de Embarcaciones Pesqueras Andaluzas - Localization and Monitoring System of Andalusian Fishing Vessel
TAC	Total Allowable Catch
TURF	Territorial Use Rights in Fisheries
VCL	Vessel catch limits

Chapter 1 : Introduction

1.1 Introduction

In 1968, Harding argued that individual interest of the users over a common resource would end with a withdrawal race in order to maximize profits. In the case of fisheries this would cause a "race for fish". As solution to the tragedy of the "tragedy of the commons", he suggested either to privatize such common property or to allocate the right to enter it.

On the contrary, there are critical voices that do not fully support Harding's thesis. Ostrom (2000) described several cases in which the lack of limited access or private property has not provoked the depletion of the resource mostly because the implication of the community in (1) the management of the resource and (2) access to the resource. Cultural and indigenous knowledge, compliance generation over generation and customary rules have ensured long-term use of the resource. For example, several fisheries in Pacific Ocean Countries have shown that customary tenure management can also provide good environmental outcomes (Aswani, 2005; Ruddle & Hviding, 1992; Dahl, 1988). However, customary tenure management seems to fail once the fishery improves technically (Dahl, 1988), and resources are depleted in the absence of effective governance as soon as the demand outstrips the biological capacity of sustaining fish stocks (FAO, 2016a).

Restrictions to open access are an essential condition for effective governance. In order to make conservation more likely, fishing rights should be allocated for specifying and constraining whom accede the resource (Charles, 2009). Nevertheless, to allocate fishing rights is not always sufficient. Rights, and institutions that surround these rights, need to create a set of incentives that encourage limiting fishing effort to what is consistent with the long-term optimal, sustainable productivity of the resource (FAO, 2016a). As said by Grafton et al. (2006), sustainability in the fishery cannot be achieved with inappropriate individual incentives and ineffective governance.

1.2 Governance and co-management

When talking about governance, one should be conscious that is a broad concept and there is not always a consensus defining it (Kooiman et al. 2008). Governance is defined by Juda (1999) as:

> "The formal and informal arrangements, institutions, and mores which determine how resources or an environment are utilized (right of access and harvest, management); how problems and opportunities are evaluated and analysed (conflict resolution); what behaviour is deemed acceptable or forbidden; and what rules and sanctions are applied to affect the pattern of resource and environmental use (enforcement)."

Other authors have given more importance to the governing interaction between systems to be governed (human system and natural system), and governing system (values, institutions and problems to be solved) involved in governance (Kooiman et al., 2008). Hanna (1999) identifies it as "the interaction between the institutional environment, property rights and individual behaviours that contribute to the outcomes of the fishery". For Kooiman & Bavinck (2005)

governance, or interactive governance as they call it, is "the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them."

In case of fisheries, that interaction should be understood as the way that the actors of the governance system interact for managing the resource.

The management spectrum is broad, with a high number of possibilities available when governing fisheries. Options go from the top down decision processes of a government centralized management to community self-governance (Figure 1). Between both, different states of co-management can be found, and the degree of it will depend on the cooperation and sharing of management duties between government and fishery stakeholders (Sen & Nielsen, 1996; Pomeroy & Berkes, 1997), been possible to have a strong intervention of the different actors in the fishery management.

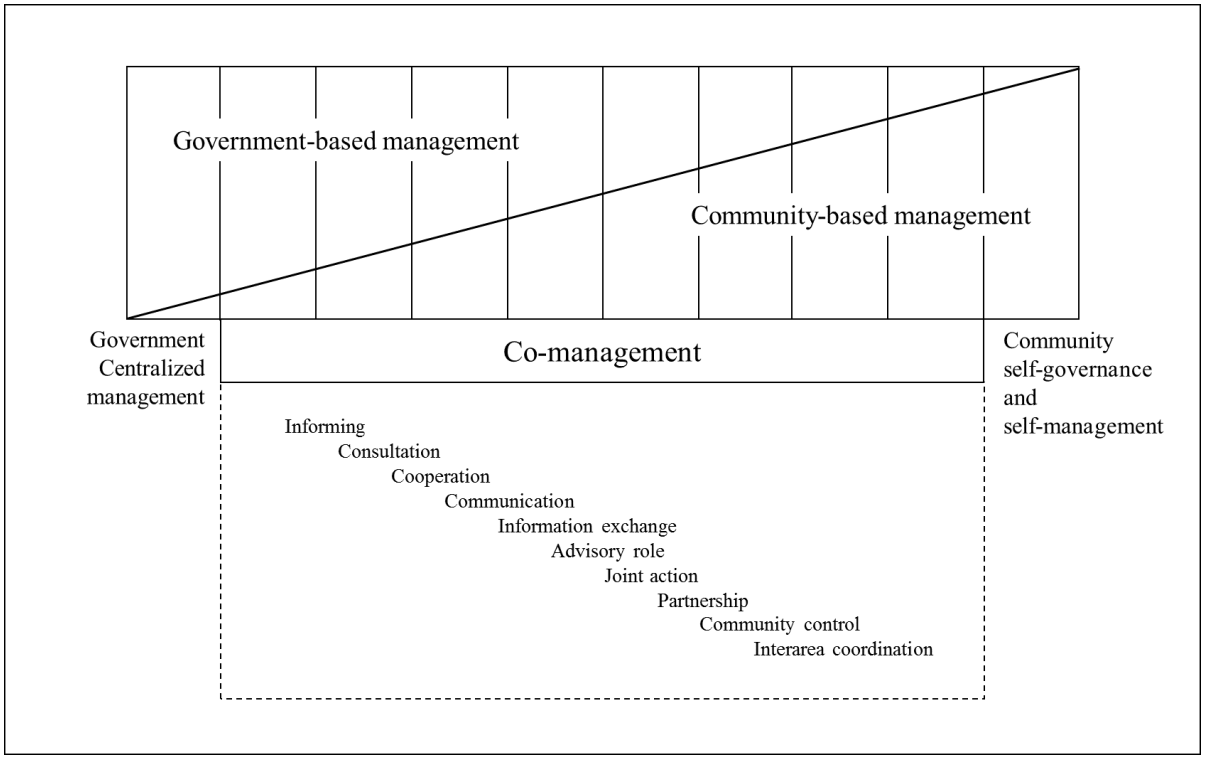

Figure 1: Hierarchy of co-management arrangements (Pomeroy & Berkes, 1997).

There is general consensus that the rigidity of the top-down management does not fit with the reality of the fishing sector and its diversity, complexity and dynamism (Hanna, 1999; Mahon et al. 2007; Jentoft & Chuenpagdee, 2009). In this regard, co-management of fisheries and the opportunities that co-management creates for facing the governance challenges have been discussed widely since the 90's (Sen & Nielsen, 1996; Pomeroy & Berkes, 1997; Pomeroy & Rivera-Guieb, 2005; Berkes, 2009; Evans et al, 2011; Cinner et al. 2012).

Several studies have shown that certain characteristics have to be present for co-management to be successful:

- Boundaries have to be well defined and should be small if possible (Pomeroy, 2001; Jentoft, 2009).

- There is a need of clear and strong leadership (Pomeroy & Berkes, 1997; Pomeroy, 2001; Gutierrez et al. 2011).
- The fishing community have to have access to financial resources and to capacity building (Pomeroy, 2001; Gutierrez et al. 2011).
- The management has to be transparent (Pomeroy, 2001; Jentoft, 2009).
- There has to be a clear membership and social cohesion (Pomeroy, 2001; Gutierrez et al. 2011; Crona et al., 2016).

Additional importance has been given to enforcement (Pomeroy 2001; Gutierrez, et al. 2011; Crona et al., 2016), since a higher participation of the fishers in the fishery it is not enough for achieving sustainability (Hauk, 2008; Jentoft, 1998; Cinner et al, 2011). Enforcement is necessary for preventing opportunistic conduct, which is more likely to be imitated when more fishers do not comply. The opportunity cost should be as high as possible to make compliance the preferred option (Roncin et al., 2004; Cinner et al. 2011).

1.3 Rights-based approaches

The nexus between co-management and clear access and harvest rights has also been observed in some of the previous studies (Pomeroy & Berkes, 1997; Pomeroy, 2001; Gutierrez et al. 2011), showing that allocation of rights can increase the possibility of attaining sustainable yields.

Since the early 60's, the use of a variety fishing rights as tool for managing the fisheries has increase. The rights-based approaches to management (RBAs), as aimed to adjust and control the fleet and the catch for the sake of sustainability (Scott, 2000).

That said, there are many types of RBAs. Sometimes polemical due to its political component (Charles, 2009), the RBA) used (from community rights to individual right) should rely on the needs of the fishery (biological, social, economic) and of the resources at disposition of the managers. A merged description of the many types of fishing rights is given using the definitions provided by Huppert (2005) and the OCDE (Le Gallic, 2006):

Input controls:

- Limited Licenses (LL): licenses which are attached to a vessel, to the owner, or to both and have to be limited in number and applied to a specific stock or fishery to be considered as market-like.
- Individual effort quotas (IE): Rights are attached to the quantity of effort unit that a fisher can employ for a given period.
- Territorial Use Rights in Fisheries (TURF): Allocation of a certain area of the ocean to a single user, usually a group, who then undertakes fishing by allocating rights to users within the group

Output controls:

- Individual quotas (IQ): Provide a right to catch a given quantity of fish from a particular stock, or, more usually, a percentage of a Total Allowable Catch (TAC). It can be transferable or not.

- Community-based catch quotas (CQ): Catch quotas are attributed to a "fishing community" with decisions on allocation of rights within the community taken on a cooperative basis.
- Vessel catch limits (VCL): Restrict the amount of catch that each vessel can land for a given period of time (week, month or year) or per trip

No matter if through individual or community rights, the RBA try to stimulate sustainability incentives through secure and definable rights (Grafton et al., 2006; Hilborn, 2005). Theoretical work support its use arguing that secure and long term property rights should provide long-term incentives for sustainability, additionally to economic efficiency (Scott, 1989; Scott, 2000; Anderson, 2000; Anderson, 2007).

Good results have been observed in fisheries with higher quality of property rights (Le Gallic, 2006), although economic efficiency is not always obtain (Parkes et al., 2009) neither recovery of the stocks and the achievement of sustainable yields (Chu, 2009; Beddington et al., 2007). Additionally, the social effects and the impact over employment of the fishing sector provoked by the RBA can differ depending of the type of fishing right allocated (Grafton et al., 2006; Olson, 2011; Hilborn, 2007).

1.4 Spanish governance

In Spain, the coastal fishing resource is managed through co-management. The co-management was established with the approval of the Spanish government of the role of the "cofradías" (Spanish fisher´s guilds) as Public law Corporations, having the state delegated tasks of an administrative character as the management of catch and sales statistics, vessel registration, the collection of certain taxes, and control of the first stage of the commercialization process (Symes et al. 2003). Influence and power between the state and the fishing sector seems to be balanced (Symes et al. 2003).

The cofradías have been operating under a TURF system even before economists established the intellectual concept (Alegret 1998; Franquesa, 2004), and have their own recognized territorial jurisdictions, over which they exercise this representation in exclusivity (Alegret, 1998). Since the 60's the cofradías have been important institutions for managing coastal fishing resources. However, the roles of the cofradía have being lately changing (Alegret, 1998, 1999a, 1999b, 2002). Twenty years have passed since Alegret (1998) pointed that

> "there is an increasing difficulty regarding to the governability of the fishing sector, not because the non-compliance of regulations, poaching, etc. but because of serious and deep structural problems that are making the actual representation, participation and legitimation system obsolete against the changes due to the capitalization of the sector, the transformation of the market and the continuous deployment of the resource."

According to Alegret (2009) situation has not changed. It seems that the actual cofradía system and Spanish governance is not contributing to the sustainability of the resource, excluding some punctual cases (Molares & Freire, 2003).

1.5 Objective of the thesis

The objective of this thesis is to evaluate if the coastal Andalusian governance and the distribution of fishing rights are contributing or not to the sustainability of the fishery of Striped venus in the gulf of Cádiz. The Striped venus clam fishery, considered an artisanal fisherie by the Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (Ministry of Agriculture & Fisheries, Food & Environment - MAPAMA), (Cortés, 2016), is one of the most importants fisheries economicaly of the in the Autonomous Region of Andalucía (Table 1).

Table 1: Top 10 species by value in Andalucía, 2015.

	2015		
SPECIES	**FAO**	**Weight (Kg.)**	**Value (€)**
SARDINE	PIL	8,804,577	15,844,611
EUROPEAN ANCHOVY	ANE	7,099,393	14,363,420
STRIPED VENUS	**SVE**	**4,570,273**	**13,093,545**
COMMON OCTOPUS	OCC	2,388,983	11,010,642
SWORDFISH	SWO	1,531,942	9,034,981
DEEP-WATER ROSE SHRIMP	DPS	435,787	7,594,920
SENEGALESE HAKE	HKM	3,153,575	6,474,131
RED SHRIMP	ARA	170,937	5,656,288
PACIFIC CHUB MACKEREL	MAS	9,468,589	5,209,318
EUROPEAN HAKE	HKE	772,040	3,965,723

Source: Data from Consejería de Agricultura, Pesca y Desarrollo Rural of the Junta de Andalucía.

The fisherie of the Striped venus has suffered two major closures in the last 10 years (figure 2), the first one in 2011 and the most recent in 2016 due to the bad state of fishing resource.

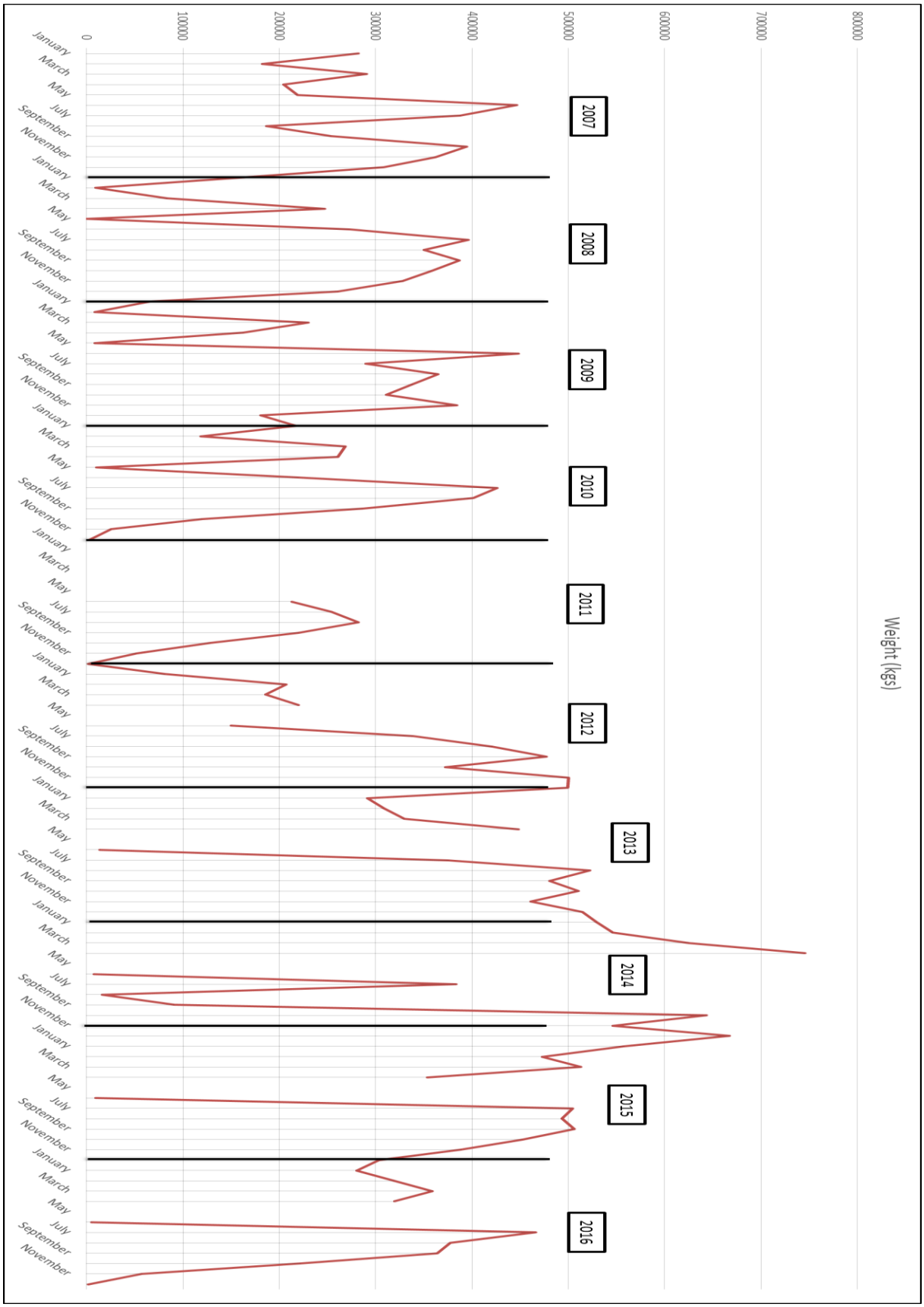

Figure 2: Production of Striped venus from 2007 to 2016 (Consejería de Agricultura, Pesca y Desarrollo Rural de la J.A., 2017)

First, the fishery is described, including the study site, the state of the resource, the fishing fleet, governance system and the different actors , putting special emphasis in the cofradías. This description is followed by the use of the governance assessment tool developed by the Environmental Defense Fund (EDF). Additionally, an economic analysis of the characteristics of the RBA is done. The combination of both methodologies provide the means for evaluating if the governance and the interests provided by the RBA of this particular fishery is contributing to the current biological state of the fishery or not.

Chapter 2 Methodology

Good governance should provide the governing structure and the tools for the different actors to interact with the environment in order to profit the opportunities that this one provides. However, without well-defined fishing rights, the wrong incentives could be stimulated resulting to bad fishing practices.

On the contrary, even if the RBA in place should provide (theoretically) good incentives for sustainable practices, a higher quality of the four characteristics previously commented will not always lead to the accomplishment of the objectives of the fishery.

If the governance structure and tools are not the appropriated, the information obtained from the environment could give a wrong image (Jentoft et al., 2010, Song et al, 2013). The response (i.e enforcement, type of management, etc.) to the image perceived could not coincide with the real problems and opportunities.

Due to their interdependence, this thesis uses a combined approach of governance attributes and characteristics of the RBA.

2.1 Governance assessment: attributes and definition

The Environmental Defense Fund (EDF) through collaboration with the Center of Oceans Solution (COS)[1]compiled what they call a "master list" of governance attributes and societal attributes that they identified as providers of good conservation outcomes. They used it for analysing the effect of governance on the sustainability and conservation goals in the Kane'ohe Bay, Hawai'i. The master list was obtained through the review of literature on institutional design and governance characteristics associated with sustainable common property resource management. A definition of each attribute is provided for further identification and analyse when undertaking the assessment of a governance system

Table 1 summarizes the attributes identified by Battista (see Appendix B for reading the full table, which includes definition and explanation of the attributes)

[1] Refered in the bibliography as Battista et al. (2016).

Table 1: Master list's summary of effective governance attributes.

Category	Attribute
Structural Attributes	Regulatory Authority
	Efficient Enforcement Mechanisms
	Governance Goals Aligned with Conservation Objectives
	Science-Based Decision-making
	Agency Flexibility
	Explicit Recognition of Trade Offs
	Dependable Funding
	Participation
	Systematic Representation
	Deliberation
	Clear Decision-making Rules
	Clear Objectives and Directives
	Accountability and Transparency
	Appropriate Scale
	Social Justice and Empowerment
	Organizational Features Designed to Allow Transfer of Authority
Societal Enabling Conditions	Capacity for Self-Organization
	Capacity for Adaptation and Learning
	Pre-existing Local/ Traditional Organizations
	Social Support and Agreement

Source: From "a Comprehensive Method for Assessing Marine Resource Governance: Case Study in Kãne'ohe Bay, Hawai'i"by W. Battista et al., 2016, Coastal management, 44, p.

2.1.1 Evaluating governance: a scoring system

Following the methodology of Battista et al. (2016), the governance attributes and societal attributes identified as providers of good conservation outcomes are evaluated by taking into account the elements of the definition that have being provide. Using the compiled definition for each item on the list as a standardized metric, the following scores are given (Table 2):

Table 2: Governance Assessment Scoring System**.**

Score	Translation
1	Low: Meets none of the qualities listed in attribute definitions.
2	Medium: Meets some, but not all qualities listed in attribute definitions.
3	High: Meets all of the qualities listed in attribute definitions.

Source: From "a Comprehensive Method for Assessing Marine Resource Governance: Case Study in Kãne'ohe Bay, Hawai'i"by W. Battista et al., 2016, Coastal management, 44, p.

The use of scores helps to the analysis, providing to the analyst the means for detecting if an element of the definition has been left aside. This scoring method can help to identify the weaknesses and strengths of the governance system that are helping or not to the fishery management goals.

2.2 Economic assessment: Characteristics of the right in the fishery and incentives

2.2.1 Economic assessment: Characteristics of the right

The type of fishing rights used is expected to affect to the fishers' interest for sustainability and so to the individual fishing behaviour.

At this regard, Scott (1989) defined several characteristics of the RBAs that have been used by several authors (Arnason, 2005, Le Gallic, 2006, Parkes, 2008) for evaluating the performance of RBAs. These characteristics, inherent to the economic concept of property right, have been linked mainly to economic performance, but also to biological recovery success.

Scott (2000) considers the performance of the exploitation of natural resources as the result of the degree of property right that its owner has. This degree of property perceived will determine their behaviour, guided by their economic interests (Hannesson, 2005). As depicted by him (1989), the weakness or strength of the property right will depend on the degree of presence of several characteristics identified as Duration, Flexibility, Exclusivity, Quality/Security of Title, Transferability and Divisibility.

However, Scott (1996, 2000) considered Flexibility and Divisibility as part of Transferability

The characteristics can be defined as it follows (Scott, 2000):

- **Duration:** Duration defines the period of ownership of the right. A property right can be own temporally (from hours to years) or be indefinitely. The degree of durability will define the objectives of the owner. A property right of short duration can stimulate the race for fish in order to maximise the profits. A property right of long duration can stimulate a sustainable behaviour of the owner and even the investment for reducing cost, increasing selectivity, increase catchability, etc.
- **Exclusivity:** Exclusivity is the right to use and manage the resource without interference. In fisheries, exclusivity will be defined as the level of freedom of a fisher who owns the right for harvesting without intervention of government, managers or other fishers. There will never be full exclusivity since government will always regulate the fishery to a greater or lesser extent (Arnason 2005) Exclusivity regards clear and effective rules of access to the resource and the overlapping between rights(Le Gallic, 2006).
- **Security of the title:** Every right-holder faces some risk that their ownership may be challenged by someone else. The degree of security suggest the degree of protection that a possessor has against threats to his property rights. In words of Arnason (2005), the security of a RBM can be define as "the probability that the owner will be able to hold on to his property right."
- **Transferability:** Transferability refers to the possibility of the right of been transferred. Even if transferring the right is not allowed and no economic value is given to it, fishers will always find a way of giving economic value to the right and even sell it. The before commented Flexibility and Divisibility are usually include in transferability as intrinsic elements of the characteristic. Only if a right is transferable and related to a quantifiable sum, this sum could be divided for further selling or leasing. The more easily you can do it, the more flexible the ownership of the right is.

2.2.2 Evaluating the fishing rights: a scoring system

In order to analyse the degree of presence of the characteristics described above, the approach carried by the OCDE (Le Gallic, 2006) and by the European Commission (Parkes et al., 2009) is used. Some modifications have been applied regarding to exclusivity for adding rigor to the assessment.
Using the definition of each of the Characteristics, scores from 1 to 5 have been given. Note that mostly all the characteristics will be present in the fishery at some extend, being the minimal score 1.

Duration:

Being the duration the period of ownership of the rights, it will measure giving intervals. The duration's score will be given following the approach of the OECD.

- One year or less (1)
- 2 to 5 years (2)
- 6 to 10 years (3)
- 10 years or more (4)
- Perpetuity (5)

Security:

As explained by the OECD, for the right to be secure, first it has to be defined and legally enforceable. The more enforceable is, the less change is perceive and the better governance structures and interaction between actors in the fishery, the more certain will be the security of the right. Following this logic, the scores are stablished by the OECD as it follows:

- Poor, if any, legal basis of rights; rights not enforceable (1)
- Rights legally enforceable, but level of enforcement is low; compliance is low (2)
- Rights legally enforceable, government retains right to adjust TAC and other technical measures (gear controls, etc.); co-management structures exist;
  some illegal fishing (3)
- Rights legally enforceable, government retains right to adjust TAC only; co-management structures are strong; little routine illegal fishing; enforcement is
  good (4)
- Rights legally enforceable against the administration; no illegal fishing; good governance (5)

Transferability:

The degree of transferability will depend on the degree of divisibility and flexibility. The more flexible and divisible the right is, the higher the score (OECD):

- Non-transferable (1)

- Transferable, but non-divisible; limits on transferability through significant ownership restriction (2)
- Transferable, but non-divisible; some government control over transfer market; minor limits on ownership (3)
- Transferable, divisible; some government control of transfer market (4)
- Fully transferable and fully divisible; free transfer market (5)

Exclusivity:

Exclusivity is complicated to define, since the number of RBA is broad, and in many cases, the type of fishery management in place will affect to a same RBA, giving as result a different level of exclusivity. For scoring exclusivity, a flowchart has been developed and used (Appendix D). The following criteria are an example of how to score exclusivity:

- no exclusivity (1): No RBA
- low exclusivity (2): No TAC; individual licenses without any spatial boundary or harvest rules
- Medium exclusivity (3): No TAC; individual licenses with informal spatial boundary or harvest rules
- Medium high exclusivity (4): TAC; individual licenses with informal spatial boundary or harvest rules. We increase the score since the establishment of a TAC and the scientific advice related to it could help the fishing community in the establishment of fishing boundaries and catch sharings
- High exclusivity (5): Territorial individual right; Individual Quota.

The four economic characteristics of the fishing right are described and represented using a radar diagram (Figure 2). The features of the right will be indicated by the area enclosed, relative to theoretical/ideal property right (a right which scores highly on all four criteria). Although obtaining a prefect property right is impossible in practice, a property right which footprint will be close to the perfect right will theoretically provide better incentives sustainable behaviours and for economic efficiency.

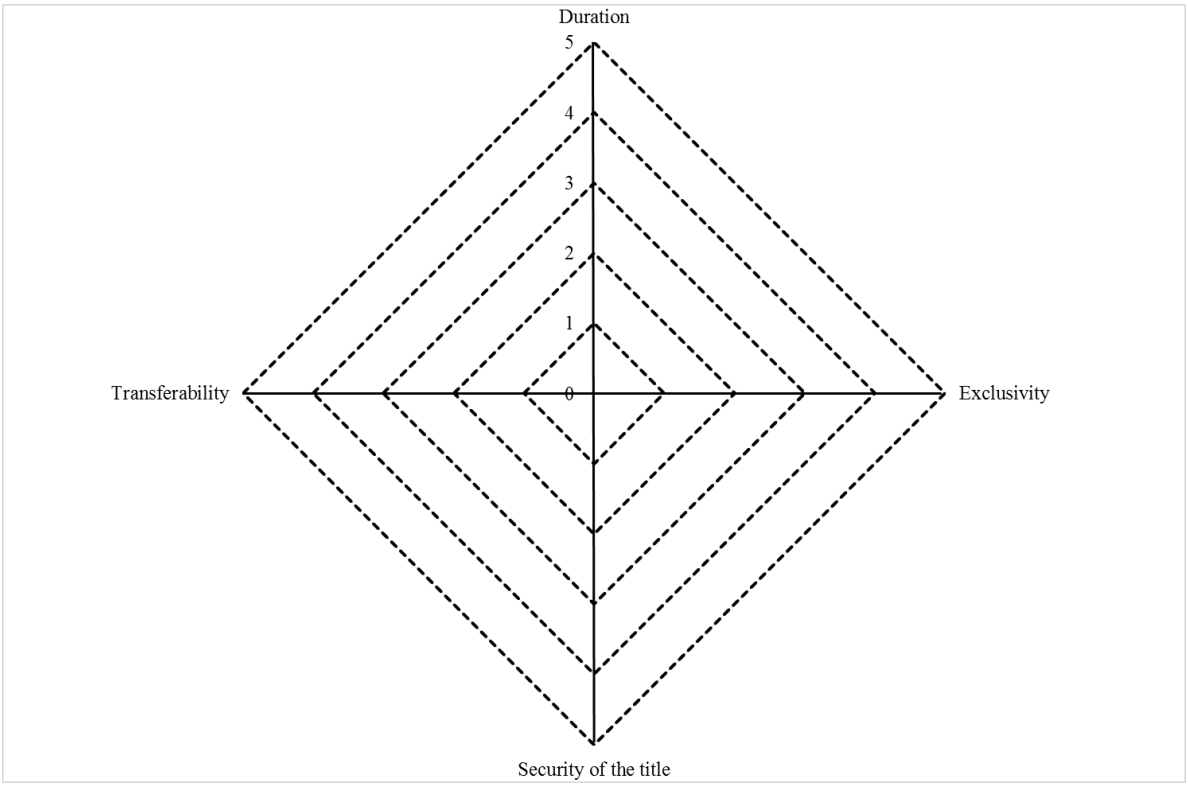

Figure 3: Radar diagram of property rights' economic characteristics

2.3 Combination of methodologies: Effect of Governance and RBA on the Striped venus fishery sustainability goals

For the case study, the Battista scoring system has been applied for evaluating the governance attributes necessary for sustainable outcomes.

The Scott approach and the combination with some modifications of the OECD, EU scoring system has been used, in order to studying the economic interests of fishers to behave sustainably.

Although appearing to be a quantitative approach, this methodology is qualitative in nature, being the numeric values used only for interpretation purpose. More important that the numerical scores, is the identification of the incompleteness of the attribute which could be, alone or in addition with other ones, affecting negatively to the outcomes.

The identification and evaluation of the relevant governance attributes and characteristics of the fishing rights have been possible through the thoroughly revision of the regulation additionally to literature review. For completing information about the resource, the fishers and the interaction between Cofradía and govern, key respondents for the evaluation and management of the resource have been interview (Appendix A). For knowing about the evaluation of the resource, the role of the cofradías in conservation activities the relation between those evaluating the resource and the cofradía, people from the IEO and AGAPA has been contacted. For knowing the role of government in the regulation of the chiral and the relation between government and cofradía, the JJAA and FACOPE have been contacted. The information about the cofradías and the relations between and within them, has been difficult

to gather. The delicate situation of the fishery since its closure on November 2016, additionally to the difficulty of contacting with the cofradías, has limited the possibilities of obtaining information from the fishing sector. However, it has been possible to contact with the cofradía of Sanlúcar de Barrameda and interviews have been carried with the technician of the cofradía, who is in charge of all the matters related with the negotiations with the JJAA and with other cofradías additionally of providing technical advice to the cofradía. In total, 5 interviews have been completed.

2.4 Study Site

2.4.1 Location of the fishery and ports participating in the use of the resource

The clam fishery of the Striped venus (*Chamelea gallina*) is a fishery carried in the gulf of Cádiz, on the south-west coast of the Autonomous Region of Andalucía. The fishery is located in the Atlantic coast of Spain, defined area 27 of the Food and Agriculture Organization (FAO) and defined area IXa of by the International Council for the Exploration of the Sea (ICES), (Figure 4).

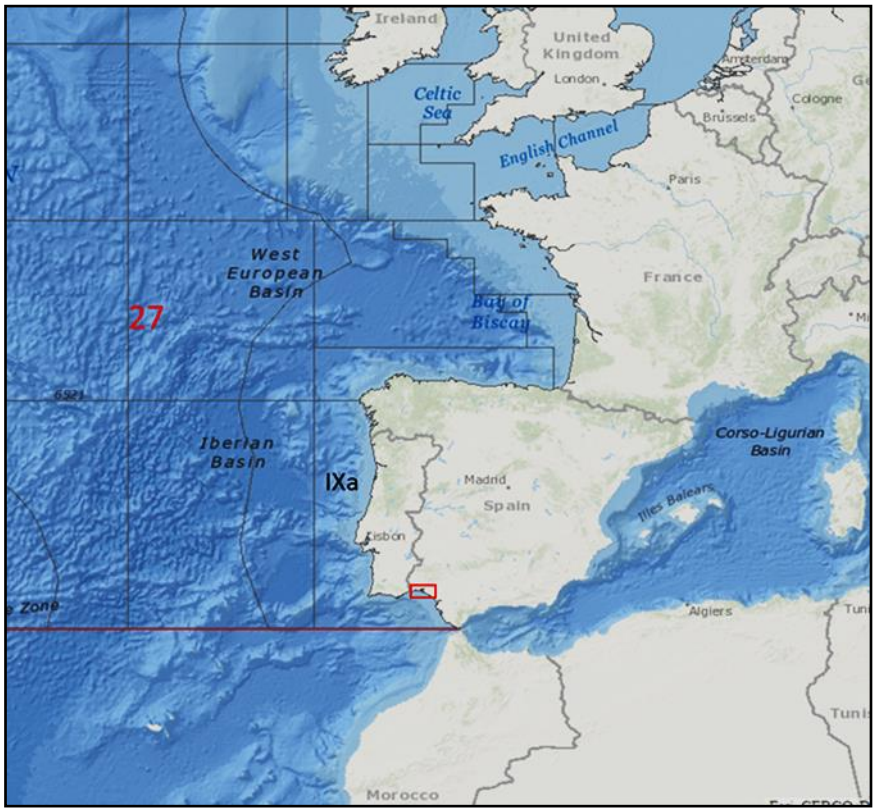

Figure 4: Location of the Striped venus fishery, area IXa ICES. *ICES spatial facility tool* (http://gis.ices.dk/sf/)

Following the study of Cortés (2016), the fleet targeting Striped venus is distributed between the ports of Ayamonte, Isla Cristina, Lepe, Punta Umbría and Sanlúcar de Barrameda (Figure 5). However, mostly all the fleet targeting Striped venus is gathered in the ports of Isla Cristina, Punta Umbría and Sanlúcar de Barrameda.

Figure 5: Gulf of Cádiz and ports. *Google maps (https://www.google.it/maps/@37.0429065,-7.0449885,77370m/data=!3m1!1e3)*

2.4.2 The Fishing Reserve of the Guadalquivir and the fishing activity

Divided in four zones identified as zones A, B, C and D (Figure 6) the fishing reserve of the Guadalquivir has as main objective to protect fishing resources and to secure the spawning of a variety of species. Only artisanal fisheries are allowed to fish in the reserve.

Figure 6: Zones of the Fishery Reserve of the Guadalquivir (Consejería de Agricultura, Pesca y Desarrollo Rural de la J.A., 2017)

The fishing activity inside the marine reserve and its zones will rely on the type of gear used. The Order of the 24th of June 2004 (BOJA No. 123, 24th June 2004) [2], modified through de Order of the 12th of July (BOJA No. 135, 12th July 2010) define the type of fishing activity that can be carried depending of the zone of the fishing reserve:

- **Zone A**: The more restricted zone due to the high level of juveniles of different fish species. Only shellfishing on foot is allowed.
- **Zone B**: Zone of nursery rich on plankton and key for the reproduction of the Striped venus. Only arts as gillnets and manual shellfishing are allowed.
- **Zone C:** Zone where the fleet targeting Striped venus in the gulf of Cádiz can operate. The shellfishing activity is only allowed from September to February (both included)
- **Zone D**: Zone where the fleet targeting Striped venus in the gulf of Cádiz can operate. The The shellfishing activity is only allowed from July to March (both included)

Both zones C and D have as objective to reinforce the protection over the other two areas.

[2] All new law or precept will be included on the official gazette of the autonomous region, Boletín Oficial de la Junta de Andalucía (Official Andalusian Government Gazette - BOJA).

Chapter 3 Description of the fishery

3.1 Target species, state of the resource, IUU fishing

3.1.1 Target species

Being of the order of the Veneroida and of the family of the Veneridae, the *Chamelea Gallina* (Linnaeus, 1758) (Figure 7) or Striped venus (Spanish common name) is described by FAO (2017) as a bivalve mollusc which inhabits bottoms of clean sand between 5 and 20 meters deep, and it feeds by ingesting a variety of algae, bacteria, and small detrital particles.

It shell is solid, thick, equivalve and inequilateral, beaks in front of the midline, broadly triangular in outline with a round anterior margin but tending to be slightly drawn out posteriorly. Its colour goes from dirty white to cream or pale yellow, occasionally polished, usually with three red-brown rays.
Its maximum length is 5 cm although the common length is between 2.5 and 3.5 cm.

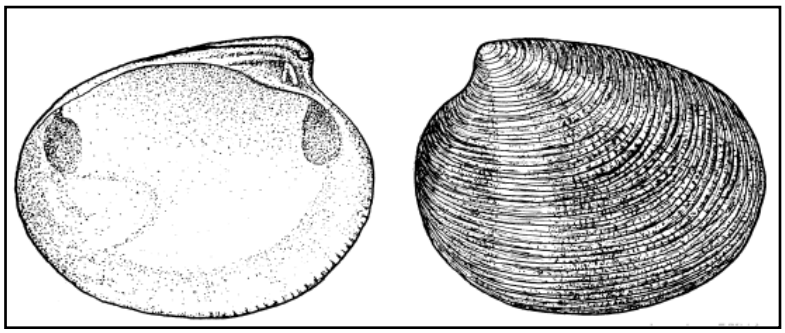

Figure 7: *Chamelea gallina* (Linnaeus, 1758) (FAO, 2017)

Two spawns characterize the period of reproduction of the Striped venus:

1) The main spawn period: May-June
2) A less important spawning period: August-September

Tending to attain the maturity at the second year of life, the Striped venus has an irregular growth. The periods of maximum growth are between August and November, decreasing it over the months of Decembers and January. In March, it starts growing again. (IEO, 2016).
Since the recruitment will be on the end of the springtime and at the beginning of summer, it is normal that the fishing yield increases too during this season.
The Striped venus is a quick growth short lived species which strongly relays on recruitment for maintaining the stock. Negative effects on recruitment (by environmental reasons or due to excessive pressure over the spawning stock biomass), will have negative effects over the abundance of the resource on the short run (IEO, 2011).

3.1.2 History of the fishery

García Ordaz (1999) amply described the short history of the Striped venus fishery. The fishery is characterized by many periods of increasing effort, overexploitation of the stocks and closures.

The first significant increase of Striped venus's landings started on 1956. However, the exponential increase of the fishing effort focused on the fishing of Striped venus did not happen until the period 1961-1968. This was favoured by the lack of control in the fishery, additionally to the closure and abandon of other fisheries because of the collapse of the fishing stocks (i.e. shrimp). This increase of the fishing effort can be reflected on the volumes of landings from 1968, when the fishery reached the historical maximum of landings (30,000 Tonnes, Cortés, 2016).

Unfortunately, this exponential increase of the effort led the stock a serious state of overexploitation, resulting on an important decrease of the fishing stock during the period of 1968 and 1974, provoking the shift of the Striped venus fishers onto other activities (gillnet, etc...).

The worrying state of the fishing stock of Striped venus obliged the Spanish State to close the fishing zone of the Gulf of Cádiz during de period 1975-1976. The decrease of the landings and the closure of the fishery induced the Spanish markets to import Striped venus from Italy, which, once the fishing zone was reopened in 1977, made the fishers fish just when there were biological closures in Italy.

This competition between the national and the Italian product induced a fleet renewal, which started on 1992 with the introduction of the mechanized dredge in the fishery. The new gear gave the possibility of competing against the foreign product and increased the profitability of the fishery. That and the possibility of fishing all the year (figure 8) (the fishers did not need to wait for the closures in Italy anymore), made the use of mechanized dredge general all over the fishery.

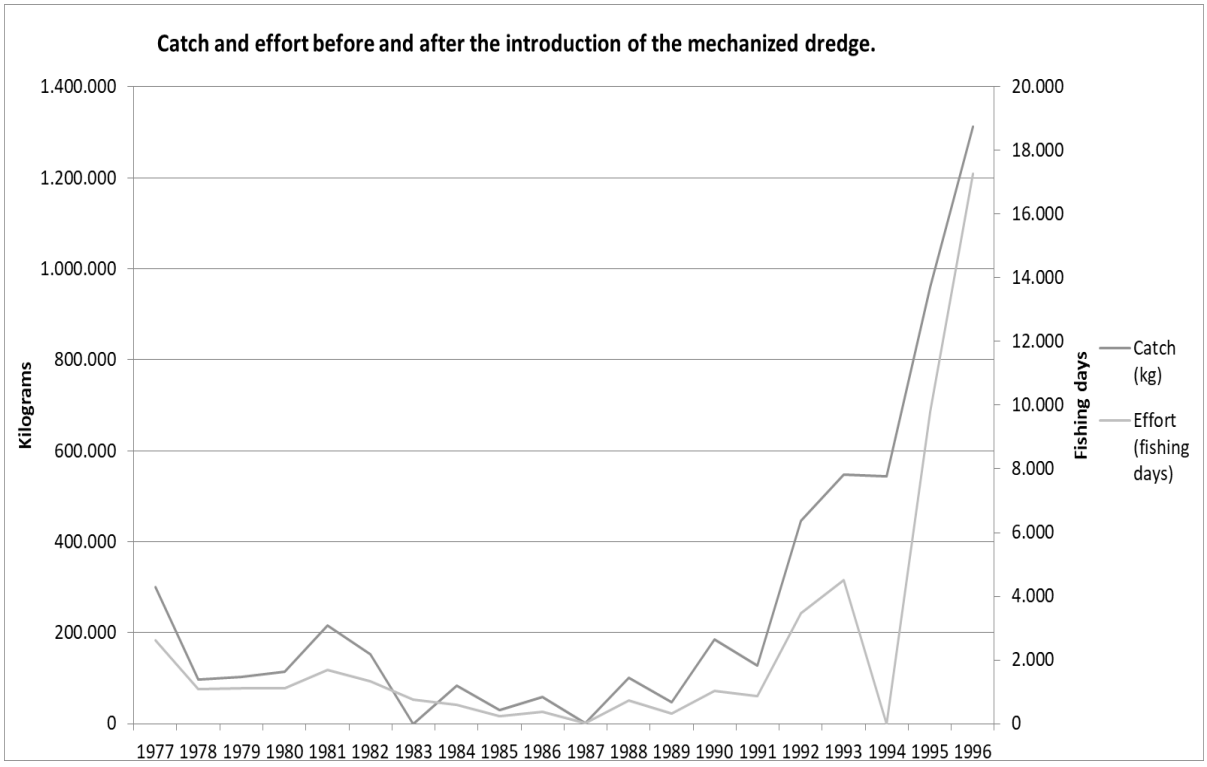

Figure 8: Catch and effort before and after the introduction of the mechanized dredge. From García Ordaz, F. (1999). Análisis económico de la pesquería de Striped venus suratlántica. Revista de Estudios Regionales, (55), 15-46.

Nevertheless, since the fishing capacity of the mechanized dredge is higher than the one of the manual dredge, the importance of the inputs control are even higher. In 2010, control measures seemed not to have been enough, and after several years of low harvest, the fishery had to close for 6 months. Previous measures seemed to work, with an increase of abundance and catch from 2012 to 2014, but a long period of closure in the end of 2014 provoked an increase of the fishing effort outside the limits imposed by the management in place. As a result, and after a bad recruitment during 2014, the poor abundance has obliged to close again the fishery at the beginning of 2016.

3.1.3 Recent state of the resource

The Instituto Español de Oceanografía (Spanish Institute of Oceanography - IEO), was asked by the Junta de Andalucía (Governmental body of the Autonomous Region of Andalucía - JJAA) to investigate the state of the resource due to the signs of overexploitation.

The study lead by the IEO in 2016 has revealed that stock of Striped venus is overfished. The fishing yield of the fleet is similar to the one of the 2010, when the fishing zone was closed due to the dangerous status of the stock.

The results were very significant. Through the study from 2008 to 2016 3 periods can be identified:

- 2008-2010, first period of overfishing. On 2010 a failure in the recruitment was detected due to the 2008's floods in the gulf of Cádiz which increased the concentration of sediments in the bottom of the sea a did not allowed the Striped venus larvae to settle and grow.

  This failure on the recruitment additionally with the increase of the fishing effort and illegal and unreported catch (Silva, 2015) was traduced by a maximum fishing yield of nearly 2kg/min. and a minimum yield of 0.1 kg/min in 2010, which obliged to the JJAA to close the fishery temporally.
- 2011 to 2014, recuperation of the stock thanks to the control of the effort and the involvement of the fishers, a maximum fishing yield of 12.5 kg/min. is obtained.
- From 2015 to 2016, were the fishing yield decrease highly due to a bad recruitment, the increase of the fishing effort (Alejandro Terrón Sigler, personal communication, March 23, 2017) and the noncompliance of the management plan by the fishers, obtaining a fishing yield of 0.35 kg/min. on September 2016.

The worrying state of the stock of Striped venus has led the Junta de Andalucía to close again the fishery from November 2016 until June 2017.

3.1.4 Illegal fishing

Following the IEO's evaluation document of 2016, part of the situation of overexploitation of the stock is due to the noncompliance of the management plan of the Striped venus.

It is not the first time that it happens. As said in the previous section (2.2.3), one of the causes of the closure in 2010 was the overfishing. The study leaded by the IEO (Silva Caparro, 2015) between December 2007 and December 2009 highlighted a gap between the reported catch in lonja and the real catch between May 2008 and May 2009.The real catch was estimated on 5045 tonnes, while the reported catch was of 2917 tonnes.

There is documented evidence of an increase of the violation of management rules (Parlamento de Andalucía, 2016; IEO, 2016)

The high numbers of infractions, summed to the failure in the recruitment on 2014, have induced the fishery to a state of overexploitation. The most common infractions have been:

i. High number of cases IEO cites 1000 cases in where the vessel fish more than the 5 hours stipulated by law.
ii. Increase in the number of incursions on the zone B of the fishing reserve of the Guadalquivir, which is key as nursery area.
iii. Detection of a high volume of immature Striped venus (under 25mm) on the all along the commercial net, being the quantity of Striped venus sold outside the lonja considerable.

It has to be noted that, additionally to the already commented use as effort estimator, the GPS is also used for controlling that a vessel fishing in a closed season or in a forbidden area
Moreover, since the selling is done through the cofradía expedition center, the control of sizes and traceability of the product can be easily obtained.

3.1.5 Biological closures

Molluscs' fisheries are very vulnerable to the quality of the water since they feed filtering the surrounding water. The presence of toxic microalgae, bacteria or heavy metals will be a reason for managers to interrupt any fishing activity. Additionally, there is a closed season of two months of May and June for ensuring the spawning. At this regard, the fishery of the Striped venus can be closed by biological, chemical and weather causes all over the year, being in the end the average of the days of closure from 2010 to 2016 (Figure 9) of more than 100 days/year.

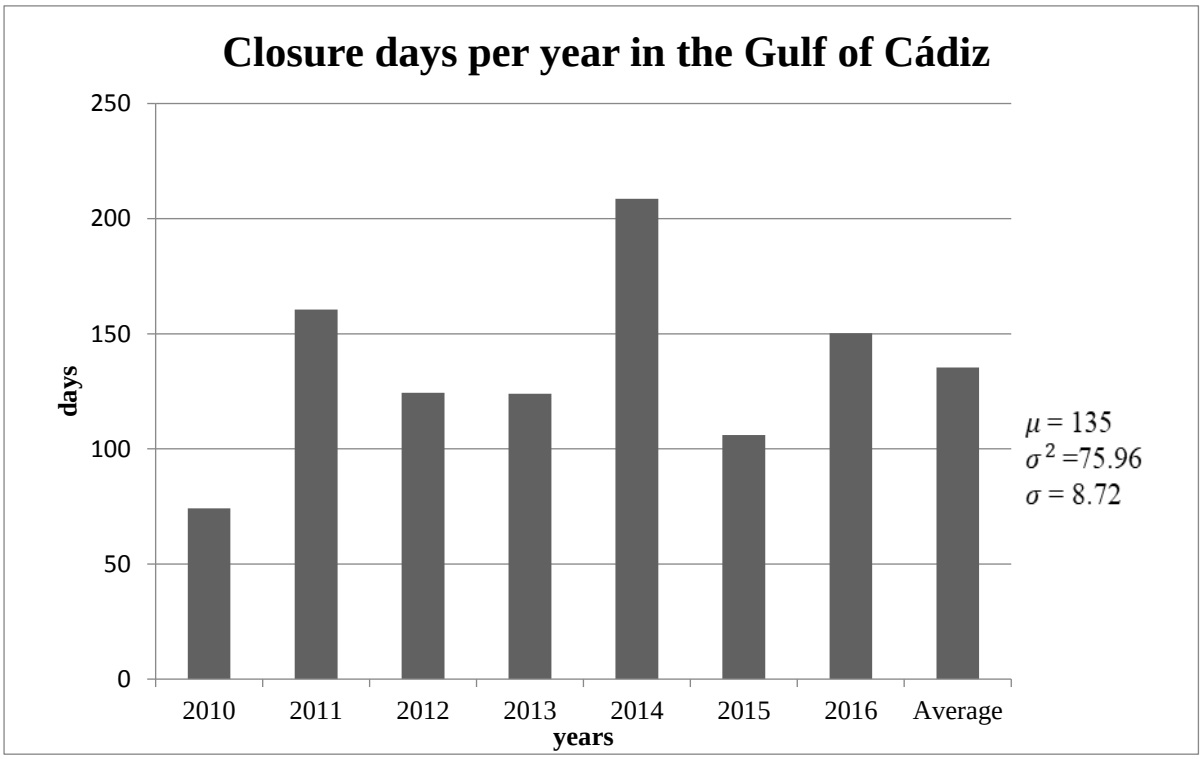

Figure 9: Average closures by biological reason other than overexploitation fishing resource of the six production zones of Striped venus in the gulf of Cádiz (Data from Consejería de Agricultura, Pesca y Desarrollo Rural de la J.A.).

The high number of closures implies that, yearly and since 2010, at least one third of the fishing days the fishery has been closed. As already commented by the IEO in their report in 2016, the high number of closures can affect to the willingness of the fishers to comply and to co-manage the fishery, and mostly taking into account that during paralysation of the fishing activity, no subvention is granted (information obtained through personal interview, 2017).

3.2 Fishing fleet and employment

3.2.1 Fishing fleet

Since the introduction of the mechanized dredge in 1992, the number of mechanized dredges has increased. However, the number of vessels has been stable since the introduction of the census of vessels through the Order 23 of September of 2008 (BOJA No. 196, 1st October 2008), where the number of vessels allowed catching molluscs and gastropods in Andalucía is registered. The census includes both mechanized dredge and manual dredge that can catch Striped venus, being their number of vessels in the fishery of the Striped venus on 2008 of 94 mechanized dredges vessels and 34 manual dredge vessels.

Since 2008, the number of mechanized dredges has been stable with the only incorporation of one vessel. The number of manual dredges has increased from 14 in 2008 to 31 in 2016 (Table 3).

Table 3: Number of vessels targeting Striped venus in the gulf of Cádiz.

Port	No. vessel	Mechanized dredge	Manual dredge
AYAMONTE	7	2	5
CHIPIONA	1	1	0
HUELVA	2	1	1
ISLA CRISTINA	52	37	15
LEPE	8	7	1
PUNTA UMBRIA	35	33	2
SANLÚCAR DE BARRAMEDA	22	15	7
TOTAL	127	96	31
% TOTAL	100%	76%	24%

Source: Data from the Consejería de Agricultura, Pesca y Desarrollo Rural, embarcaciones marisqueras con arte de rastro y draga hidráulica con puerto base en el litoral del golfo de Cádiz (25/01/2017).

However, the fleet of manual dredge not only focus in the Striped venus, but also in other molluscs, and can even change the gear.

Regarding to the characteristics of the fleet, and following the definition of artisanal fishery provided by the MAPAMA, the fleet can be considered artisanal since the average Gross Register Tonnage (GRT) is inferior to 20 GRT, their average length is inferior to 15 meters and they fish less than 24h a day (Cortés, 2016). The fishing capacity and power of the mechanized dredge is generally higher than the one of the manual dredge (Table 4). Additionally to its power, the fact that the number of mechanized dredges is three times superior plus the fact that the manual dredge can change the target species makes the impact of the mechanized dredge over the resource greater.

Table 4: Characteristics of the vessels targeting Striped venus in the gulf of Cádiz.

Port	**Mechanized dredge vessels**			**Manual dredge vessels**		
	Average GRT	Average Length overall	Average power (kW)	Average GRT	average Length overall	Average power (kW)
AYAMONTE	9.92	13.04	69.50	3.03	8.12	33.83
CHIPIONA	7.47	11.00	80.00	-	-	-
HUELVA	13.41	13.57	121.00	3.35	7.49	24.00
ISLA CRISTINA	12.14	13.30	103.65	2.93	8.27	28.69
LEPE	14.32	14.72	161.29	2.79	7.49	30.00
PUNTA UMBRÍA	13.22	13.76	118.21	4.09	8.29	29.50
SANLÚCAR DE BARRAMEDA	11.42	13.12	112.19	3.02	7.03	41.71
TOTAL AVERAGE	12.48	13.51	111.97	3.05	7.91	32.57

Source: From Cortés Rodríguez, C. (2016). La técnica multicriterio de programación por metas en la gestión de la pesquería de chirla ("Chamelea gallina") de la región suratlántica Española.

After consideration, the study, when analysing the Striped venus fishing fleet, will be focused on the mechanized dredge, since:

- The manual dredge vessels fish other molluscs additionally to the Striped venus and studies about the fleet and its effect over the resource have not been obtained.
- No specific regulation for controlling the fishing effort over the fishery of the Striped venus has been funded referring to the manual dredge.
- The impact of the mechanized dredge over the Striped venus is higher than the impact of the manual dredge, because of their higher number and fishing capacity.

3.2.2 Mechanized dredge

Representing 76% of the Striped venus fishing fleet, the mechanized dredge (Figure 10) is by far the most used gear in the Striped venus fishery.

Figure 10: Mechanized dredge. (Huelva Información, 2016)

The mechanized dredge can be described as a parallelepiped gear and its dimension will rely on the power and characteristics of the vessel, althought the average size is of 2.75 m. of length, 2 m. of width and 0.45 of height[3]. The dredge includes hydraulic jets dredges that help to dig and to wash out the molluscs that have buried themselves in the seabed (FAO website). The mollusc, unburied, enters in the gear. Additionally, the gear is equipped with a sieving machine for selecting the Striped venus with a size of 25mm or superior (minimum size, see section 2.5.2)

There is two ways of proceeding when fishing (Figure 11). (1) After anchoring, 200-300 meters of cable are thrown (the cable is connected to the anchor) while getting away of the anchor. The mechanic dredge is thrown by the bow and, then, it digs while the vessel goes backwards while the crew withdraws the cable. The crew stop fishing once the vessel arrives to the point where the anchor is. The fishing is performed at 2.5 nautical nots (miles/hour) maximum and it will be repeat several time changing the course 5 degrees each time

[3]Information provided by the cofradía of Sanlúcar de Barrameda. Retrieved from http://cofradiapescadoresdesanlucar.com/flota/marisqueros/

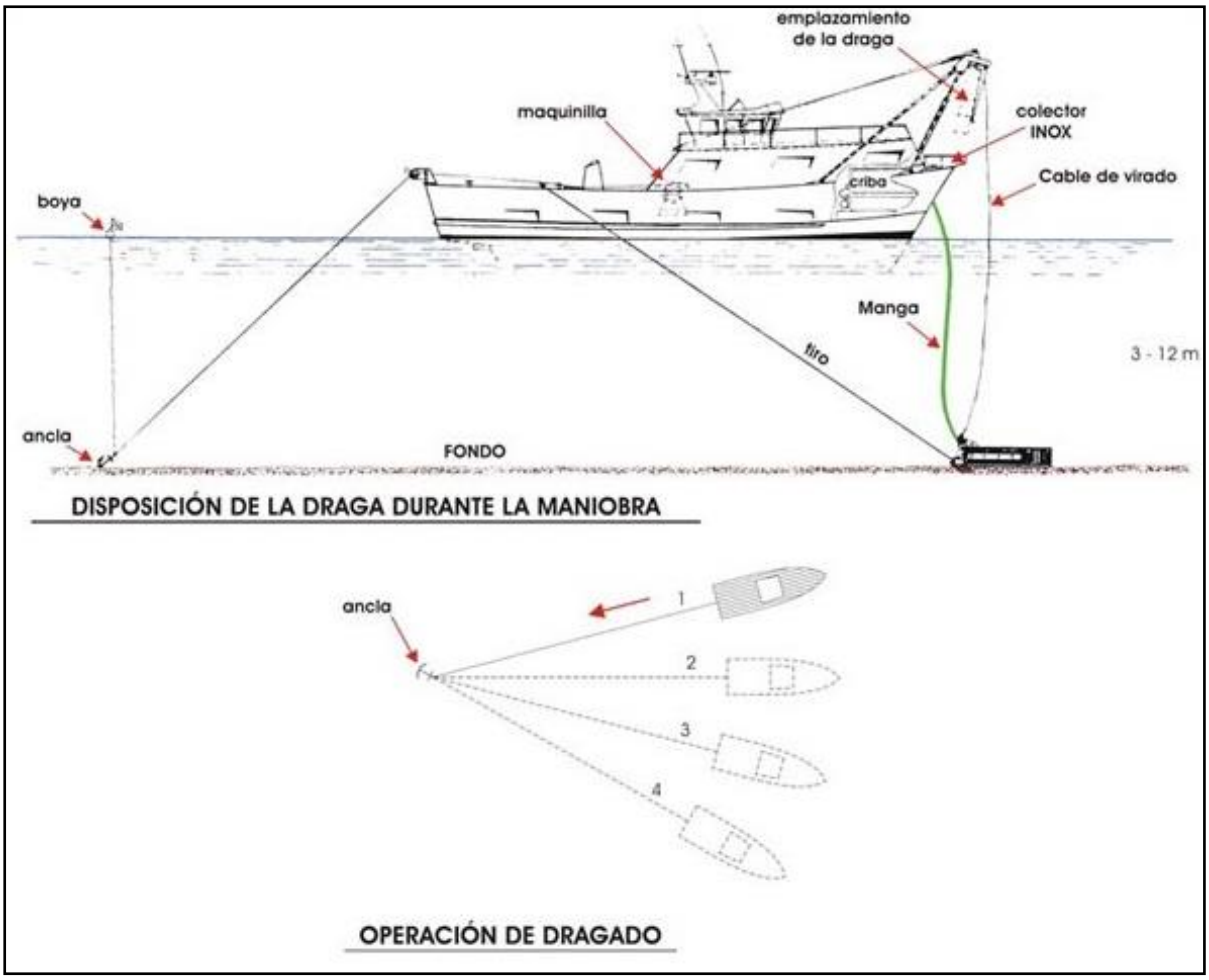

Figure 11: Fishing procedure. (chirlas, 2013)

Referring to the selectivity of the mechanized dredge, nearly 71% of the species caught by the fleet of mechanized dredges in the gulf of Cádiz corresponds to the *Chamelea gallina* (Silvia & Juárez, 2013), being nearly 46% of it discarded because they size is under the legal size. The 29% of the catch left is composed by 68% of other mollusc, 9.4% crustaceans, 0.5% fishes and 22.1% of other species.

All the bycatch is discarded, due to the regulation of the fishery of Striped venus, even if the species fished have commercial value. However, taking into account the elevate rate of discard's survival of the catch with hydraulic dredge on the Alborán Sea (Gallardo-Roldán, 2015), we could think that similar survival rates can be considered for this fishery.

3.2.3 Employment

With an average of 3 fishers by mechanized dredge, the Strip venus clam fishery provide 13% of the total employment in the port studied (table 5)

Table 5: Employment provided by the mechanized dredge fleet

	Mechanized dredge	*Rest of the fleets*	*% of the employment represented by the mechanized fleet*
AYAMONTE	6	345	2%
ISLA CRISTINA	111	824	13%
PUNTA UMBRIA	99	428	23%
SANLUCAR DE BARRAMEDA	45	423	11%
LEPE	21	168	13%
TOTAL	282	2,188	13%

Source : Data from Consejería de Agricultura, Pesca y Desarrollo Rural de la J.A. (2017)

3.3 Fishery legislation

3.3.1 Spanish legislation

As part of the European Union (EU), the Spanish Government regulates the fishing resources under the umbrella of the Common Fisheries Policy (CFP) of the EU. The MAPAMA is ministry in charge of creating basic fishing legislation framework of the country.

In this context, the Ley 3/2001 del 26 de Marzo de Pesca Maritima del Estado (State Marine Fisheries Law 3/2001 of the 26th of March - LDPMDE), sets the basic legislation on fisheries of Spain, contemplating the law the following issues:

I) Maritime Fisheries on external waters
II) Management of the fishing sector
III) Commercialization and transformation of fishing products
IV) Fishing investigation and oceanography
V) Infractions and sanctions
VI) Regulation of the fishing vessels on the Fishing Vessels' Census

However, since the approval of the Spanish Constitution on 1978 (article 148/11), the Spanish State recognises the right of legislate and execute of the Autonomous regions in their internal waters as an exclusive competence, in order to manage their fisheries.

3.3.2 Autonomous Region Legislation

With the approval of the Spanish Constitution on 1978 and under the Statutes of Autonomy approved the following years, the exclusive control and management of the coastal zones and any activity developed until 12 nautical miles is carried by the different Autonomous Regions of Spain (article 149.1.19 of the Spanish Constitution).

In the case of the Autonomous Region of Andalucía, the Statute of Autonomy was approved the 30th December 1981, with a last modification on with the Organic law 2/2007 of the 19th of March the Statute of Autonomy of Andalucía specifies in its 48th article regarding to fisheries:

i. Exclusive competence over every maritime fishery, shellfishery, aquaculture, artisanal fishing, professional diving and titles for recreational activities on its internal waters.
ii. Management of the fishing sector, specifically over the professional conditions for the execution of the fishing activity, construction, security and registration of vessels, hiring lonjas, promotion and social protection of the fishers and others working in the fishing sector. Investigation, innovation, development, technologic transference and fishing formation.
iii. Vigilance, inspection and control of the competences regulated on the previous articles.
iv. The Autonomous Region share competences also in the planning of the fishing sector and fishing harbours.

The Consejería de Agricultura, Pesca y Desarrollo Rural (Ministry of Agriculture, Fisheries and Rural Development - CAPDR) of the JJAA is the governing body in charge of elaborating the fishing legislation in the autonomous region. The Law 1/2002 of the 4th of April 2002 (BOJA No 45, 18th April 2002) establish the legal framework of the fishing activity and aquaculture of the Autonomous Region based on the The State Marine Fisheries Law 3/2001. The law regulates the following themes:

I) General Provisions
II) Rational use of the resource in interior waters
III) Professional marine fishing on interior waters and shellfishing
IV) Recreational fishing on interior waters
V) Improvement and adaptation of the fishing fleet
VI) Structure of the fishing sector
VII) Regulation and promotion of marine aquaculture
VIII) Commercialization of fishing products
IX) Investigation, technological development and training on fishing and aquaculture activities
X) Monitoring and inspection
XI) Infractions and penalties

3.4 Management of the Striped venus fishery

Under the framework of the Law 1/2002, the Autonomous Region of Andalucía has been adapting the management of the fishery to the status of the sock., establishing different measures for limiting the effort in the Striped venus fishery with input controls, technical measures, monitoring and enforcement, and also output controls (diary catch limits per vessel until 2011). We have to point out that even if two types of fishing fleets fish Striped venus in the gulf of Cádiz, the mechanized dredge fleet is the one has an specific management plan. The manual dredge has to be included in the same census of the mechanized dredge, it the characteristics of the gear are regulated and, they have to respect the minimum size of the chiral and the closures. However the manual dredge can target other species and are not submitted as strictly to any effort limitation since, even if they the same schedule of activity (exit and entrance into the port, hour of start and hour of end of the fishing activity), the manual dredge vessels do not have a maximum number of fishing hours.

That said, the management of the fishery until 2016 has being following the management plan from 2011. The management plan, based on the Order of the 24th of June 2011 (BOJA No. 128, 1st July 2011), modified through de Order of the 26th of July (BOJA No. 149, 1st August 2011),

had as objective to regulate the fishing effort of the fleet of mechanized dredge operating in the fishery of the gulf of Cádiz which ensure the responsible used of the fishing resources and the improvement of the fishing fleet for adapting to the fishing resource available. Since 2011, the JJAA has been adapting the management of the fishery to the status of the sock. Although it seems that it hasn't been enough. The management plan in the fishery until the closure on November 2016 included the following measures.

3.4.1 Input controls:

Fishing licenses and census

The main way of controlling effort in the fishery of the Autonomous region of Andalucía is by using fishing licenses and closing the vessel census so no more vessels can access to the fishery. At this regard, The Decree 387/2010 (BOJA No. 214, 3rd November 2010), modified through the Decree 99/2015 (BOJA No.44, 5th March 2015) establish that for gathering shellfish from a vessel is necessary the specific license for shellfishing from a vessel.
The Order of the 24th of June 2011, modified through de Order of the 26th of July establish that only mechanized dredges that have the license for gathering shellfish and are included on the list of mechanized dredges of the Junta de Andalucía's shellfishing activity census, (created on 2008). Additionally, new vessels could only integrate the fishery in case that it substitutes an older one which realized the same activity. New vessels will have at maximum the same GTs and Kw. However, even if the census is theoretically closed, the number of mechanized dredge has increased from 93 in 2008 to 96 in 2016.

Limitation of the fishing effort

In order to limit the pressure over the fishing stock, the JJAA through the Order of the 24th of June, modified through the order of the 26th of July, establish that the mechanized dredge vessels could fish a maximum of 5 hours per day.

3.4.2 Technical measures

Regulation of the fishing activity

The legislation contemplates technical measures regarding times restriction. The Decree 387/2010, modified through the Decree 99/2015 establishes that fishers can only perform their fishing activity from Monday to Friday, being forbidden to fish on weekends and holidays. The Order of the 13th of June of 2013 (BOJA No. 119, 20th June 2013) regulates the journeys and schedules of the shellfishing and fishing activity of the gulf of Cadiz. Regarding to the gathering of Striped venus it establish that the hour of exit from the port will start at 5:00 am. Vessels should be at port at 4:00 pm.
Zones restriction is also contemplated through the Order of the 24th of June 2011, modified through de order of the 26th of July, were the Autonomous Region dictates that mechanized dredges can only access to the zones where there is Striped venus, and they are only authorized to fish Striped venus.

The minimum sizes of the catches and closed seasons[4] for the bivalve molluscs and gastropods of the Autonomous Regions of Andalucía are regulated through the Order of the 25th of March of 2003 (BOJA, No. 65,4th April 2003). The Order establishes the minimum sizes of the catches and closed seasons for the bivalve molluscs and gastropods of the Autonomous Regions of Andalucía. The Striped venus minimum size is 25mm and it closed season will start from the 1st May to the 30th of June.

Monitoring and enforcement

The JJAA putted in place their own satellite based system called Sistema de Localización y Seguimiento de Embarcaciones Pesqueras Andaluzas (Localization and Monitoring System of Andalusian Fishing Vessel - SLSEPA). Colloquially known as "Caja Verde" (Green Box) (Figure 12), this device gives the ID of the vessel, position, direction speed, hour and data. As mentioned by Order of the 24th of June 2011, modified through de Order of the 26th of July, the Green Box has to be installed in all the artisanal vessels. It use is key for assuring compliance can control that a vessel is not fishing more than allowed or that it does not enter on any of the forbidden zones. Furthermore, its use allows the gathering of useful data as could be the fishing effort for estimating the Catch per Unit Effort (CPUE)

Figure 12: "Green Box" lighthouse style. (Consejería de Agricultura, Pesca y Desarrollo Rural de la J.A, 2017)

Regarding to enforcement, the Autonomous Region of Andalucía contemplate several enforcement measures that the owner of the license and the vessel do not follow the order, he

[4] The closures of 2010 and 2016 have been also included on the BOJA. The orders referring to the closures has been:

Orden of the 16th of December of 2010 (BOJA No. 245 17th December 2010), which determined the complete closure of the fishery from the next day after the publication of the BOJA until the 15th July 2011.

Orden of the 30th of November of 2016 (BOJA No. 232, 2nd December 2016), which determined the complete closure of the fishery from the next day after the publication of the BOJA until the 30th June 2017.

can face the temporal immobilization of the vessels or the suspension, withdrawal and impossibility of renewal of the license for a maximum period of 5 years (according to the Law 2002/1).

Additionally, the landings are regularly inspected by the by the JJAA, in order to have in mind that there are not irregularities.

3.4.3 Negotiation and new regulations 1st July 2017

After de closure in November 2016 multiple negotiations have been carried between the sector of the Striped venus and the JJAA, and with the assessment of the IEO (figure 13).

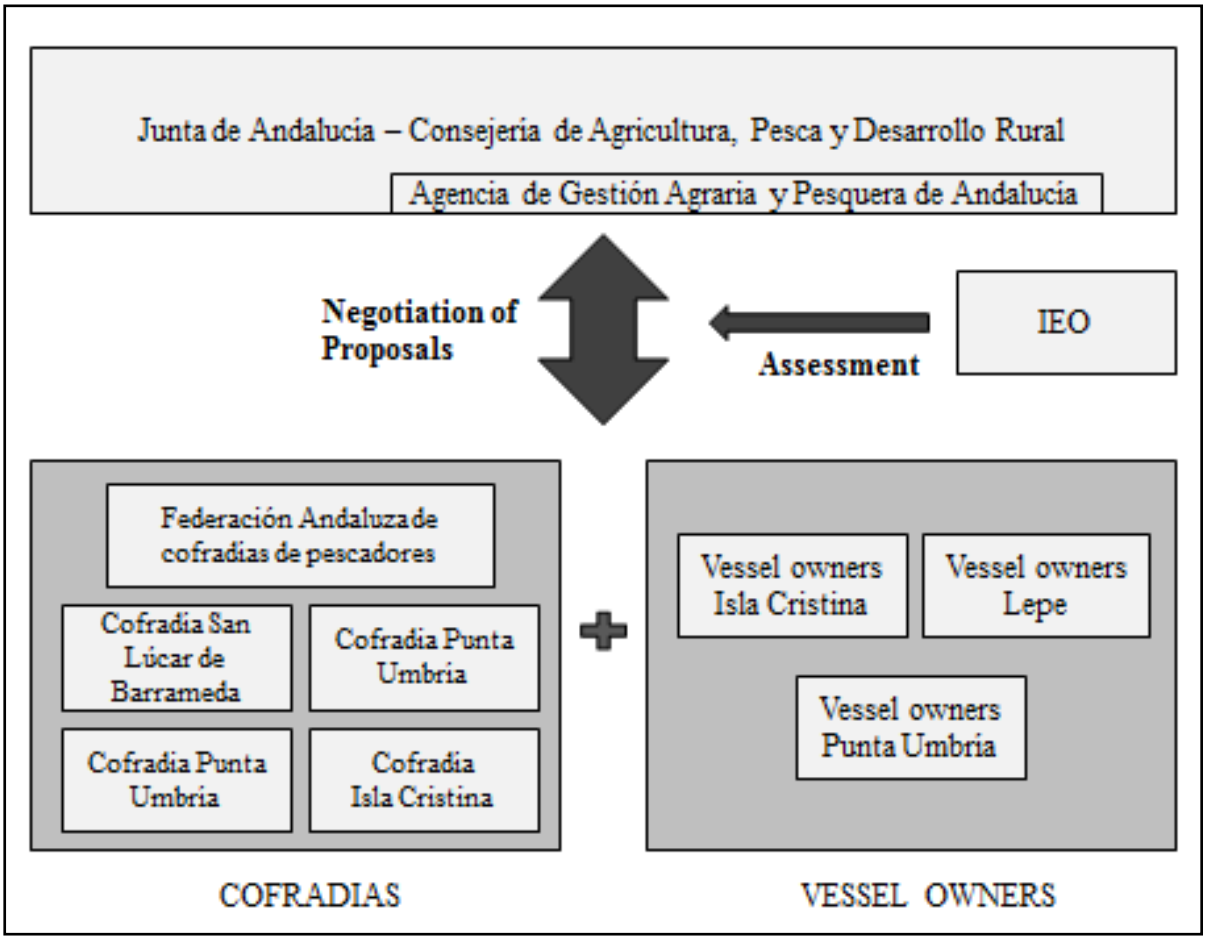

Figure 13: Negotiations for the new management plan between cofradías and JJAA (information obtained through personal interview, 2017)

Through the Order of the 29th of June 2017 (BOJA No. 124, 30th June 2017) it has been written a full management plan, including all the elements of previous orders and decrees and, additionally, actualizing previous articles and including new ones. While the first management plans in 2011 had as objective to control and reduce the fishing effort, this new management plan has as main objective to ensure Maximum Sustainable Yield (MSY) by regulating the fishing activity (Table 6).

The most important measures that have been included by the order 29 of June 2017 have been the inclusion of output controls for the first time since the suppression of the 200kg/day vessel

catch limit on 2011 (Cortés, 2016) since the catch limit was not efficient (IEO, 2016) for controlling the fishing effort.

Table 6: New regulations of the management plan of the Striped venus fishery June 2017.

Input control	Output control	Technical measures	Enforcement

• Additionally to the previous licenses, the owner of the vessel has to have an authorization from the Government of Andalucía for the use of the mechanic dredge.
• Maximum Fishing Hours allowed have been reduced from 5 hours to 3 hours.
	• The cofradías and Ship-owners associations could establish a maximum quantity of commercialization and first selling of the product in the three lonjas of the ports authorised.
	• Establishment of biological limits:
	  ○ A catch limit of 2,500t/year
	  ○ Minimum average CPUE of 0.8kg/minute
	• Once the 90% of the catch limit has been reached, the JJAA can close preventively the fishery for analysis the state of the resource.
	• If the 0.8kg/minute are not reached, the JJAA will evaluate the fishery and it will close it in case of not being enough.
	• If the CPUE is equal to 0.6kg/minute or inferior, the fishery will be closed automatically.
		• Suppression of the characteristics of the sieving machine
		• Definition of forbidden zones:
		  ○ Zones closed by sanitary reasons.
		  ○ Zones closed by biological
		  ○ Zones closer than 0.25 miles to the baseline.
		  ○ Zones A and B of the Marine Reserve of the Guadalquivir
		  ○ Any zone where the activity is not allowed
		• The landings should be carried in the ports of Isla Cristina, Punta Umbria and Bonanza. The selling should be carried in those ports.
			• Inclusion of reasons of revocation of the new authorizations for the use of mechanic dredge:
			  ○ Non-compliance of the characteristics that the gear should have
			  ○ Fishing during a non-authorised fishing day
			  ○ Fish more time than allowed
			  ○ Fishing activity in forbidden zones
			  ○ For navigating in the forbidden zone less than 6 knots (or nautical miles)
			  ○ Fishing activity while the fishery is closed
			• Process of retreat of the authorization will start after a minimum of three incompliance cases
			• Additionally to the sanctions of 5 years, subventions and public helps can be denied for 2 years and the licence for fishing can be retired for 4 months

Source: Boletín Oficial de la Junta de Andalucía No. 124, 30th June 2017.

3.5 Stakeholders

3.5.1 Fishers' cofradías

Historical role:

The cofradías (Spanish fishers' guilds), since the 1978 and as defined by LDPMDE as non-profit corporations of public right, who act as consultation organs which collaborate with the Autonomous Regions in order to ordinate the fishing sector.

However, the role of the cofradías in coastal fishery management in Spain has been notable since centuries, although at different degrees (Franquesa, 2004, Barrios, 1998). With documented data of their presence in Spain since the XII century and with the condition of religious guilds, the kingdom of Spain granted to the different Spanish cofradías the access to the resource on a territorial basis. This system worked until The XIX century, when the political changes in Spain, stimulated by the French revolution, weakened the power of the King and the Church. As religious guild, the cofradías where abolished, but they did not disappear. The cofradías changed their institutional appearance from religious guild to different institutions as industrial associations, cooperatives, owners associations, workers societies, etc. It was not until after the Spanish civil war and the instauration of the Authoritarian Government, that the cofradías were reinstituted as a fishers' organization of corporative nature and institutionalized that aimed to control the resource. The aspects of community-based resource management and the co-management structure are conserved until today.

Cofradías in Andalucía nowadays and the Striped venus fishery:

The cofradías and its configuration are regulated by the Autonomous Regions since 1992 (Ley Orgánica 9/1992, de 23 de diciembre, de transferencia de competencias a Comunidades Autónomas) and as already mentioned, the cofradías have a consultant role and collaborates with the administration in the management of the fishery. The autonomous region of Andalucía recognise the consultant role of the cofradías in the Article 41 of the Law 1/2002, being also indicated the duties that can be assigned or are assigned to the cofradías by the public administration. Those duties, mostly related to the artisanal sector, refer to the fishing activity and commercialization of the catch. Their duties are the following ones:

i. Act as consultative organ of the public administration on the elaboration and application of rules that can affect the fishing sector.
ii. Act as consultative organ of the public administration in the elaboration of studies and reports when the public administration asks to.
iii. Present to the public administration proposals in order to improve the fishing sector (or fishery in particular), particularly those proposals that pursue to improve the technical, economic and social conditions of the fishing activity, especially in the artisanal sector.
iv. Act as collaborative organ of the public administration referring to the fishing activity and commercialization of the catch.
v. Promote formation activities related with fisheries for the professionals of the sector
vi. Act as public offices for the reception, the registration and processing of the documentation directed to the CAPDR
vii. Represent and defend the economic and corporative interests of their members.

The structure and the operation of the cofradías is regulated by the Decree 84/2004 of the 2nd of March (BOJA No. 52, 16th March 2004), and broaden and developed by the Order of the 26th of February (BOJA No. 6, 11th January 2005). The Order establish the basic principles that should govern the creation, constitution and the operation of the cofradías, being this principles based on: (1) Democratic structure, (2) Members' participation, (3) equal representation between fishers and vessel owners, (4) freedom of membership, (5) submission to the CAPDR tutelage, (6) Economic Management autonomy, (7) Interest Management of its members.

The Order of the 26th of February also determines the management structure of the cofradías. The structure should be the following one:

Junta general: integrated by the same amount of fishers and ship owners representing the different fleets integrating the cofradía, the Junta general is the superior management organ of it. Also, the Junta decides all the important matters related to the cofradía's budgets, self-imposed fishery management measures, control of the fishing activity, additionally to other duties that can be present on their statutes. The leader elected of the cofradía is the "Patrón Mayor" which could be a fishers or a ship-owner, and the Junta general elects him. His role is to be the representative of the cofradía. The "Vicepatrón Mayor" will be also elected by the Junta and will substitute the Patrón Mayor in case of need.

Cabildo: Integrated also by the same amount of fishers and ship owners representing the different sectors of the cofradía, being it role to administrate the ordinary matters of it.

It has to be noted that although the membership in the cofradía is voluntary, the selling of the catch can only be performed through the lonja (for fish) or an expedition centre (for molluscs), buildings owned by the cofradía for the first sale of the landings. This obliges the fishers to be inscribed in the cofradía. Nevertheless, the fact that the catch can only be sold through the lonjas or expeditions centres ensures the recollection of data plus the control and traceability of the landings.

Some cofradías do not have lonjas or expedition centres since they don´t have enough volume of fish or enough funds for making it work. Other ports don´t even have a cofradía, as for example Lepe. However, agreements can be reached between cofradías and vessel owners for them to sell in other cofradías´ markets.

The Order of the 23rd of June of 2007 (BOJA No. 22, 30th January 2007) establishes that the only cofradías that can sell Striped venus are the cofradías of Isla Cristina, Sanlúcar de Barrameda and Punta Umbria. The vessels of the ports of Lepe and Ayamonte can and have to sell its products in the rest of cofradías. By proximity we suppose that the vessels of Ayamonte sell in Isla Cristina and the vessels of Lepe sell in Punta Umbría.

Federación Andaluza de Cofradías de Pescadores

The cofradía system is articulated so the individual cofradías could be a properly and efficiently represented when negotiating with Autonomous Regions and the Spanish Government. Each cofradía will integrate a provincial federation, a regional federation, and the National Federation (Federación Nacional de Cofradías de Pescadores - FNCP) (Figure 14).

In Andalucía, the Decree 84/2004 and Order of the 26th of February also contemplate the role of the Federación Andaluza de Cofradías de Pescadores (Andalusian Federation of Fishers' Guilds - FACOPE). The FACOPE has as function to represent the cofradías and to manage and coordinate the common interest of this ones. The FACOPE will have also a Junta general which will be integrated by the Patrón mayor and Vicepatrón mayor of the cofradías of the Federación Provincial (Provincial Federation), representative organ which groups individual cofradías from the same province.

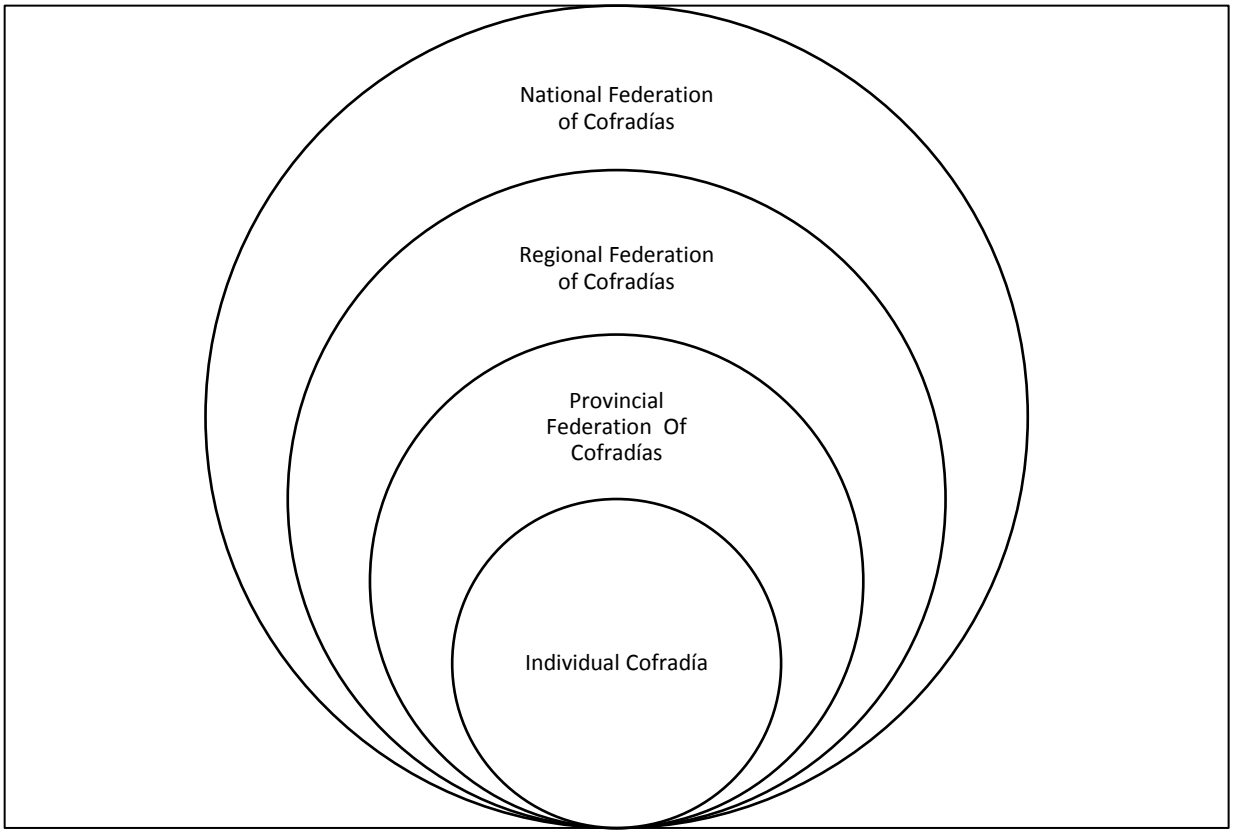

Figure 14: Representation system of the cofradías (local, provincial, regional and national)

3.5.2 Other stakeholders

Ship-owners associations

The ship-owner association are companies' associations legally recognized by the JJAA, being defined by the article 38 of the Law 1/2002 and its functions included in the article 39. Only composed by vessel owners, has as objective to defend the interest of the vessels owners that are affiliated to the association. Its duties, related to the fishing activity will be will to:

- Participate in the management of the fishery in order to secure the rational and responsible use of the fishing resource, collaborating with the JJAA in the elaboration of management plans and the following of its execution.

In the Striped venus fishery the following vessel owners association intervene in the management:

- Isla Cristina,
    - Asociación Armadores Asoisamar
    - Asociación Armadores Asodraga
- Asociación de armadores Punta Umbria
- Asociación de armadores Ayamonte
- Asociación de armadores Lepe

The only port that don´t have a vessels owners association is the port of Sanlúcar de Barrameda, since they consider that the cofradía represent efficiently the interest of the vessels owners (information obtained through personal interview, 2017).

Governmental Organizations

IEO:

The IEO is a Spanish public research organization focused on marine science investigation. Its main purpose, cited by the Royal Decree 1950/2000 of the 1st of December 2000 (BOE No. 289, 2nd December 2000)[5], modified through the Royal Decree 718/2010 of the 28th of May (BOE No. 139, 8th June) is the technological research and development and the transfer of knowledge about the sea and its resources. Additionally, as contemplated by the Law 14/2011 of the 1st of June 2011 (BOE No. 131, 02nd June 2011) it has as role to assess to the, State or Autonomous Region which requires oceanographic and marine science assessment. There are nine oceanographic centres in Spain, being the IEO of Cádiz one in charge of the evaluation of the resources of the gulf of Cádiz. The IEO, under agreement with CAPDR, evaluated the fishery for the first time in 2008-2009 (IEO, 2016), being the scientific assessment body of the JJAA. Since then the IEO has been doing samplings each 15 days (information obtained through personal interview, 2017). The IEO elaborates the reports referring to the state of the fishery when the JJAA ask it, being the first one in 210. The last study carried by the IEO has been on 2016 being the study that confirm the dangerous situation of the stock.

AGAPA:

The Agencia de Gestión Agraria y Pesquera de Andalucía (Agrarian and Fishery Management Agency of Andalusia - AGAPA) as an agency of special regime (articulo 54.2.c)) which, as part of the JJAA, has as objective to support and assess to the JJAA referring to the Agriculture and Fishery Sector. AGAPA would be in charge of communicating to the JJAA if something threatening the fishing resource, and they will assess on the elaboration of measures for facing the situation. As specific labour, AGAPA is in charge of the monitoring the fishing activity of the artisanal fleet through the SLSEPA. Also, AGAPA is will carry inspection of the fishing activity of the artisanal fleet on the field, incrementing the number of inspections ,for example, when the biological closure of the Striped venus or other molluscs are in place. They may do the samplings for analysing the state of the resource regularly (information obtained through personal interview, 2017).

[5] All new law or precept will be included on the official gazette of Spanish State, Boletín Oficial del Estado (Official State Gazette - BOJA

Chapter 4 Results

In this chapter we expose (1) the results of the governance assessment of the coastal governance (2) and the property rights´ economic assessment of the fishing rights present in the Striped venus fishery.

4.1 Governance assessment

4.1.1 Structural Governance Attributes

Regulatory Authority

The Autonomous Region of Andalucía, as granted by the Spanish Constitution and the Statute of Autonomy of Andalucía, has exclusive competence over maritime fishery, shellfishery, aquaculture, artisanal fishing, professional diving and titles for recreational activities in its internal waters. The CAPDR as part of the JJAA is the governing body in charge of elaborating the fishing legislation in the autonomous region. As part of its jurisdiction, the CAPDR regulates the fishery of the Striped venus in the gulf of Cádiz. Through the IEO and the AGAPA, the CAPDR receives information about the state of the stock additionally to the behaviour of the fleet so they can modify the regulation in accord with the circumstances.

SCORE: 3

Efficient Enforcement Mechanisms

The CAPDR has the power to impose penalties in accord with the Law 30/1992, 26 of November (Ley 30/1992, de 26 de Noviembre de Régimen Jurídico de las Administraciones Públicas y del Procedimiento Administrativo Común, y el Reglamento del Procedimiento para el ejercicio de la potestad sancionadora), approved by the Royal Decree 1398/1993, 4th of August. The JJAA elaborates an annual plan with specific objectives of monitoring and enforcement for each fishery. AGAPA will execute the monitoring and enforcement plan by controlling the fleet through the SLSEPA system detecting acts of non-compliance such of fishing activity in the fishing reserve or more fishing hours that allowed (public security corpses of the state in charge of the protection of the nature). AGAPA will also program inspection of the expedition centres for checking that molluscs without the proper characteristics are sold. In case of detecting an infringement of the regulation, it could be identified as: minor infringement, serious infringement and very serious infringement. The type of penalties that CAPDR will impose will depend of the type of infringement, going from warnings and fines, to suspension of the fishing license or decommission of the gear and vessel. The way that the CAPDR decides what penalty to impose will depend on the effect of the illegal activity on the resource, the existence of intentionality, the recurrence, and the profit obtained when committing the infringement. However, it seems that the permissiveness in the fishery makes the enforcement weak. The last closure of 2016 has been provoked by the non-compliance of the management plan in place. Not all the fleet is involved, but a small percentage of the fleet is well known by its illegal activity, and even if the CAPDR knows it, it does not paralyze the vessels or increases the hardness of the penalties (information obtained through personal interview, 2017). Problems have been detected with the monitoring

system, which has not been working well since 2014. Fishers realized that the JJAA was not able of repairing the Green Boxes that were not working because a lack of budget. They started breaking the Green Boxes and they increased their illegal activities. In fact, it is known that some vessels have been fishing while the fishery has been closed in 2016 (information obtained through personal interview, 2017). Some fishers even use small boats where they transfer part of the Striped venus caught (information obtained through personal interview, 2017)

SCORE: 1

Governance Goals Aligned with Conservation Objectives

The management plan of the Striped venus established on 2011 by Order of the 24th of June 2011 specifies that the objective of the management plan is to regulate the fishing effort of the fleet of mechanized dredge operating in the fishery of the Gulf of Cádiz for ensuring a responsible use of the fishing resources and the improvement of the fishing fleet for adapting to the fishing resource available. The objective is in line with the Council Regulation (CE) No. 2371/2002, 20th of December 2002, for granting the use of the fishing resource in order to achieve sustainable economic, biological and social condition. Additionally the management plan contemplates a fishing ban in the Zones of the fishing reserve of the Guadalquivir identified as nursery zones of different species which can be threatened by the fishing activity of the fleet targeting Striped venus.

SCORE: 3

Science-Based Decision-making

The IEO, under agreement with CAPDR, has been evaluating the fishery since 2008-2009, samplings each 7-15 days and providing scientific assessment to the CAPDR (information obtained through personal interview, 2017). An annual report of the fishery is sent to the CAPDR, elaborating additional reports when the CAPDR request it. In fact, the CAPDR asked to the IEO in 2010 and 2016 to elaborate a report about the state of the stock, being the reports the basis for new regulations in order to solve a situation of overexploitation.
Additionally, AGAPA provide scientific support by having periodically on-board observers that take data for its further use on the estimation of the MSY, recruitment, discards identification the zones where the effort is concentrated and the estimation of the CPUE through the SLSPA and landing data (information obtained through personal interview, 2017).

Nevertheless, it seems that the collaboration of the cofradías with the CAPDR in the management is quite limited. New ideas are not normally proposed, and when they are, they are not usually supported by other cofradías or within the cofradía itself, being difficult to achieve a consensus between them. As an example, the cofradía of Sanlúcar de Barrameda is the only one that has proposed a specific management plan with a proposal of distribution of the TAC established in the new regulation of 2017. However, none of the other cofradías have approved it yet. In fact, the cofradía of Sanlúcar de Barrameda is the only cofradía that has hired someone with scientific background for assessing the fleet of the cofradía and representing their interests in case of need (information obtained through personal interview, 2017).

Even though, there is some agreement in the need of the scientific knowledge for the sustainability of the fishery and the attitude of the fishers seems to have changed at this regard during the last 10-12 years. Ten years ago, the fishers did not allow scientists of the IEO and AGAPA to use their vessels for sampling. They started acceding just if the CAPDR paid for them to let the scientist to go on board of their vessels. Now, they do it for free (information obtained through personal interview, 2017) (although, not all the fishers).

SCORE: 2

Agency Flexibility

There is flexibility regarding to the management responsibilities that can be assigned to the cofradías. In fact, the CAPDR is negotiating with the FACOPE for creating a new regulation of the Cofradías and its Federations for increasing the role of the cofradías in the fishery management and commercialization information obtained through personal interview, 2017). However, right now is unlikely that governance structure of the Striped venus fishery is going to change. The cofradías could have more administrative responsibilities as for example managing the depurations centres, following the state of the resource and help with the stock assessment and to monitor and enforce the landings and their commercialization. Nevertheless, as said above, only Sanlúcar de Barrameda has someone hired with scientific background, and the sector by itself seems not to participate actively in the in management.

SCORE: 2

Explicit Recognition of Trade Offs

The main objective of the CAPDR is to obtain the sustainability of the resource, and it is the priority. No formalized mechanism has been identified for making choices when a conflict of goals is present in the fishery.

SCORE: 1

Dependable Funding

The assessment and management of the fishery is carried by the public administration through public funds. However, the crisis in Spain has provided some problems of funding for the Autonomous Regions, and this could have been reflected in the management, as it has happened with the repairing of the Green Box (information obtained through personal interview, 2017). The cofradías are self-sufficient since each member pay a quota for maintaining the functioning of the cofradía. Regarding to economic aids for conservation services, economic incentives have been provided to the fishers for helping in the sampling activities by lending their vessels. Nowadays they are not paid and they do it for free.

SCORE: 2

Participation

The cofradías, which include all the stakeholders involved directly with the fishing activity, have a consultant role (recognised by law) and collaborates with the administration in the elaboration of the fishery management regulation. Depending on the situation of the fishery, the number of meetings between cofradías and CAPDR will vary. There are periods when the cofradías meet the CAPDR several times during the year and others when they haven't done meetings in more than six months (information obtained through personal interview, 2017). The opinion of the cofradías is always taken into account (if the CAPDR consider it reasonable) and the participation could be by meetings, workshops and monitoring commissions of fishing areas (information obtained through personal interview, 2017). For example, during the elaboration of the new management plan in 2017, 14 of 17 proposals of the fishers have been included in the new regulation. It is generally agreed that relation between CAPDR and cofradías is good (information obtained through personal interview, 2017).

SCORE: 3

Systematic Representation

The relevant stakeholders, fishers and vessel owners, are both present in the negotiation. Fishermen are represented by the cofradía, and vessel owners are represented by cofradías and vessel owners both. The two groups are identified by the legislations and they take part of the negotiations. They all have voice at the negotiation. Additionally, the fishing sector of the Striped venus has always someone who´s more involved and act as leader of the sector within the cofradía**.** (information obtained through personal interview, 2017).

SCORE: 3

Deliberation

There is a formal process for negotiation and discussion between cofradías and Spanish institutions. Formally, the cofradías of Isla Cristina, Punta Umbria and Sanlúcar de Barrameda and Ayamonte discuss between them before presenting their needs/demands/suggestions through FACOPE, which should represent the interest of the cofradías as if they were just one institution (information obtained through personal interview, 2017).The FACOPE has the support of a representative of each cofradía, being normally one of it the Patrón Mayor and the leader of the Striped venus fleet in the cofradía. The sector has the right to expose it opinion, although the CAPDR will have the last word. The IEO will mediate and assess regarding to the measures used. Informally, the role of FACOPE has been lately diminished. For example, in case of the negotiation of 2016, FACOPE, even if present, did not intervene (information obtained through personal interview, 2017). Its representative role reduced, the fishery is losing the possibility of having a single and strong voice.

SCORE: 2

Clear Decision-making Rules

Decision making rules and outcomes are estimated through modelling by the IEO so there is no ambiguity when proceeding and elaborating the new regulation (information obtained through personal interview, 2017)

SCORE: 3

Clear Objectives and Directives

As already said the CAPDR established the objective of the fishery in the regulation of 2011, which said that the objective of the regulation is to grant the use of the fishing resource in order to achieve the sustainable economic, biological and social condition of the fishery.

The Order of 2011 included in its article 18, that for achieving the sustainable use of the resource, a reduction of the fishing capacity of the fleet had to be carried, being the 30th of June 2013 the limit for doing it. The objectives and task for attaining this reduction were:

- To reduce the total fishing capacity (measured in GRT and kW) of the mechanized dredge fleet at least 8%.
- The reduction of the fishing capacity will be carried by the reduction of the fleet.

The report of the Spanish State about the situation of the fleet in 2013[6] shows that by 2013 the capacity of the fleet was reduced although it calculates it taking to account the whole fleet without separating mechanized dredge and manual dredge. The IEO, however, estimated that no more reduction of the fishing capacity had to be carried.

Yet, no more control of the fishing capacity has been carried until 2016, having the fleet of mechanized dredge increased their total GRT by 4% and the total kW by 39% (Appendix E).

SCORE: 2

Accountability and Transparency

The CAPDR is expected to justify actions or decisions if needed; in the Parlamento de Andalucía (article 106.3 of the Statute of Autonomy of the Autonomous Region of Andalucía) as it happened with the closure of the fishery in 2016 (Parlamento de Andalucía, 2016). Performance reports will be published by the CAPDR when they will ask to the IEO to do a specific report about the state of the fishery, but most of the information regarding to the day a day activity in the fishery is not public. Nevertheless, relevant information about the fishery is included on the website of the JJAA, which provides free information for the consumer , for example the report from the IEO 2016, the regulation of the fishery included in the BOJA, the contact of the cofradías, access to the state of the fishing zones by species (closed or not), etc. Additionally, the CAPDR provide

[6] http://www.mapama.gob.es/es/pesca/planes-y-estrategias/anexo2013version3final2_tcm7-374733.pdf (25/08/2017)

all the information to the fishers that is not subject of data protection (catch information, scientific reports, market information, etc.), and considers that the management is transparent (information obtained through personal interview, 2017). Regarding to the management activities, the management power is not all concentrated by the CAPDR since AGAPA is in charge of the monitoring and enforcement, IEO is in charge of the stock assessment and the cofradías are in charge of the administrative duties imposed by the JJAA (management of the expedition centres, support in the sampling activities, intermediation between sector and public administration, support in administrative activities). The budget of the CAPDR, AGAPA and IEO are public and can be accessed through internet and can be audited by external or state agents. When an important decision takes place, as the closure, the JJAA publish in its web why the situation is taking place and it includes the information needed (i.e. the IEO report of 2016) for justifying the decision. However, on a day a day basis the information about the condition of the resource may not be accurate, since de previsions of the IEO cannot take into account the volume of Striped venus which is fished illegally or sold under the legal minimum size. Management measures o prevision could be not what the fishery needs due expected flows of benefits can also not be accurate. Management decision are not independent of political or special interest since for example the increase of the fleet, which census is closed, has been also due to provincial and local political pressures with the last incorporation of a vessel in the census in 2016 **(**information obtained through personal interview, 2017)

SCORE: 2

Appropriate Scale

The Striped venus has a specific fishery management plan centred in the fishery of the zone of the gulf of Cádiz. Nevertheless, there is a part of the local condition that is missed in the regulation of the Striped venus fishery, the role of the manual dredge. The fishing activity of the mechanized dredge is widely regulated, with a periodical revision of the regulation when the status of the stock requires it. However, the fleet of manual dredge is barely regulated, except for the minimum size of the Striped venus (which is the same for all the fleets targeting Striped venus), the exit and entry hours to port (also the same for all the fleets targeting Striped venus) and the characteristic of the gear. Contrary to the mechanized dredge fleet, the manual dredge fleet has not fishing time restriction. This situation is creating conflict between the mechanized dredge fleet and the manual dredge fleet since the first ones think that they are not treated fairly (information obtained through personal interview, 2017).

However we have to point out that, although if it is true that the manual dredge has fewer limits for harvesting the resource, there are reasons for not including them in the same regulation. The reason is mostly because of the number of species targeted by the manual dredge and the fishing capacity of the vessels. Compering to the mechanized dredge, the manual dredge has not the same fishing capacity (three times less) and it can target other species (four in total). So, limiting the number of hours may not just be as effective as with the mechanized dredge, being also be prejudicial for the manual dredge fleet.

All the same, it is true that a limit has to be established. The ideal catch control measure for the manual dredge fleet should be a daily vessel catch limit as the one that they have with the coquina *(Donax trunculus)*

SCORE: 2

Social Justice and Empowerment

All rules and regulations pertaining to the Striped venus fishery management of the gulf of Cádiz go through a number of different comment periods as described above. During the process cofradías can provide comments and suggestions related to the new regulation.
Yet, the non-inclusion of the manual dredge in the limitation of the effort is perceived as unequal and as a threat to the fishing right of the mechanized dredge fleet. A more specific regulation and definition of the fishing rights of the manual dredge could help to reduce conflicts between fleets.

SCORE: 3

Organizational Features Designed to Allow Transfer of Authority (e.g., polycentricity and nesting)

Institutional power and interaction is well defined by the Statute of Autonomy and the Law 1/2002. The management of the Striped venus fishery can be described as multilayered since, although the Autonomous Region of Andalucía has exclusive control of its interior water, several actors participate in the management of the Striped venus fishery and have specific duties. JJAA delegates the management of the fishing resources to the CAPDR, which in turn delegate monitoring and enforcement to AGAPA (also part of the JJAA) and the study of the state of the stock to the IEO since 2008 through periodical contract renewal between IEO and JJAA (the last one in from 2016 until 2020; information obtained through personal interview, 2017). Local management and administrative duties are given to the cofradías at a local level.

SCORE: 3

4.1.2 Societal Enabling Conditions

Capacity for Self-Organization

Each cofradía has a recognised and official leadership, the Patrón Mayor, being chosen among the fishing community through a democratic process. The Patrón Mayor represents the fishing community itself (vessel owners and fishers) in front of the JJAA. Additionally, within the fleet, it seems that there is always someone who has representative power for representing (informally) the specific sector, as it happens in Sanlúcar de Barrameda, where one of the vessel owners (he owns half the fleet) act as head of the sector in the negotiations (information obtained through personal interview, 2017)
Self-organization and coordination could exist between and within cofradías. All self-imposed operational rules (control of the selling and regulation of the effort), are allowed and supported by the Autonomous Region, although it is though informal recognition. A good example is the self-imposed 120 kg daily Vessel Catch Limit in 2017 after the reopening of the fishery. However, self-organization in the sector is normally unsuccessful. Several attempts of self-regulation have been carried by the cofradías without clear success. In 2013, the mechanized dredge fleet self-imposed a catch limitation for the selection of bigger Striped venus when fishing. These measures, focused on the control of the Striped venus sold for better prices, lasted shortly,

and in 2014 fishers started not following this self-imposed management measures (IEO, 2016; information obtained through personal interview, 2017).

Despite the previous commented attempt of self-regulation, the cofradías of the gulf of Cádiz are static referring to self-organization, and the agreement of all the fleet is nearly impossible. A clear example is the management plan of Sanlúcar de Barrameda, which has not been approved yet. (information obtained through personal interview, 2017).

Failure of self-organization and possible conflicts come also from what is perceived by the mechanized dredge fleet as unequal regulation between the manual dredge regulation and the mechanized dredge regulation. (information obtained through personal interview, 2017)

Additionally the fact that in some cofradías exist more than one vessels owner association, as in Isla Cristina (Asociación de Armadores Asoisamar, Asociación de Armadores Asodraga) could increase the difficulty of arriving to a common understanding.

Regarding to the boundaries and the proximity of the fishing port to the stock, the ports are not far away of the fishing zone, although boundaries are not well defined.

SCORE: 2

Capacity for Adaptation and Learning

Extensive capacity for adaptation and learning exist in the Gulf of Cádiz. IEO and AGAPA work for ensuring that reliable data is available for it use in the Striped venus fishery management regulation. This data includes monitoring for estimating the correct volume of catches. Additionally, the fishery is relatively small and fishers know each other and know who does not comply, being easy for them to monitor and enforce if they want.

SCORE: 3

Pre-existing Local/ Traditional Organizations

The TURF cofradías system has been in place for centuries, changing its shape for adapting to different politic climates. Nowadays, cofradías have a formal role as public consultative organs with official recognition by the State, being their duties mainly administrative for supporting the fishery management carried by the Autonomous Regions.

Still, it cannot be said that general trust exists between the cofradías of the Gulf of Cádiz and within the cofradías themselves. The relation between manual dredge fleet and mechanized dredge fleet is not the best one do to management discrepancies. Also, it is not possible to have agreement within the mechanized dredge fleet since there is disagreements and lack of cohesion (information obtained through personal interview, 2017).

It is obvious that participants doesn´t discount the future at an appropriate rate, since the fishery has being closed 2 times in 6 years due to illegal fishing and excess of fishing effort.

SCORE: 2

Social Support and Agreement

Previously we have highlighted that part of the fleet do not comply and self-organization is complicated due to different interests, division of opinions and too much passivity from the fishers. Nonetheless, is mostly general the elevate interest that all the stakeholders have regarding to the importance of the obtaining a sustainable yield of the fishing resource (Cortes, 2016). Fishers recognise the role that they have played regarding the depletion of the stock and they have assumed the new regulation of the fishery approved in June 2017 even if they are not satisfied with it (information obtained through personal interview, 2017).

SCORE: 3

4.2 Property rights´ economic assessment

The property rights of any fishery in the Autonomous Region of Andalucía are allocated under the umbrella of the Law 1/2002 of the 4th of April 2002 which establishes the legal framework of the fishing activity. The law will not only define how and who holds the fishing right (Title III). It will also establish the management measures available for the CAPDR (Title II), the definition of the actors intervening in the fishery (Title VI of the law), plus the enforcement measures regarding to the illegal fishing (Title X and XI).

Regarding to the allocation of the rights, the third title of the law 1/2002 identify how the right is conceded. The article 17 says that for fishing in internal waters, a specific license has to be expelled, being the license used for fishing with a mechanized dredge a shellfishing from vessel license. The article 19 notes that the vessel that wants to fish on internal waters has to be included in a specific census by gear.

In the case of the Striped venus, the Order of the 24th of June 2011, which has settled the management plan of the mechanized dredge vessels fishing activity until June 2017 under the framework of the law 1/2002, point out that the only vessels that can fish Striped venus are the ones included in the census from the Order of the 23rd of September 2008 of shellfishing vessels (manual and mechanized dredge both) based in port of the gulf of Cádiz.

Since the right is legally recognised, it can be also evaluable. It characteristics can, if not determine, incentive fishers to behave in a way or another. The fishing right is analysed by looking at the 4 characteristics of the property right, being these ones (1) Duration, (2) Security, (3) Transferability and (4) Exclusivity.

4.2.1 Duration

The decree 387/2010, in its article 6.2, defines that for the shellfishing activity from vessel, the validity of the licenses that authorizes the activity will be submitted to the compliance of the requisites required by the permanence normative included in the article 7 of the Order of the 23rd of September 2008. A specific period of validity is not included, being the right permanent if the vessels meet the following conditions sited in the article 7:

- To confirm to the CAPDR, when required, that the vessel has been fishing at least for three months during the previous twelve months since the confirmation has been required
- In case of buying of substitute a vessel included in the census, to communicate it to the CAPDR.

SCORE: 5

4.2.2 Security

Rights legally enforceable

As previously said, the articles 17 and 19 of the third title of the law 1/2002 identify how the right is conceded and the specific regulation of the Striped venus fishery defines who can fish, being then the right legally define, and thus enforceable.

Regarding to the enforcement of the right, the Order of the 24th of June 2011 will protect the right of the fishers who can target the Striped venus by imposing penalties based on the law 1/2002. The Order of the 24th of June 2011 establish that any mechanized dredge without license or which is not in the census of the mechanized dredge will be penalized, and the infringement will be considered as a serious infringement which, following the law 1/2002, will be always penalised with a fine that will be between 301€ and 60.000€. An additional penalty could be imposed, being these ones:

- Seizure of the gear/s.
- Seizure of the catch.
- Suspension, removal or no renewal of any license for a maximum period of 5 years.
- Temporal retention of the vessel until the payment of the fine. The vessel can be confiscated.
- Banning for developing any fishing activity for a maximum period of 5 years.
- Banning for receiving any subvention or public help for a maximum period of 5 years.

Role of the Government in the management of the Striped venus

The title II of the law 1/2002 disposes that the JJAA, through the CAPDR, will establish measures targeting the conservation and improvement of the fishing resource. In particular, the article 13 of the Title II specifies that the CAPDR can establish specific management plans for a concrete fishery or for a fishing zone for determining the optimum fishing effort in accord to the situation of the resource, always taking into account the socioeconomic conditions of the sector and the sustainable use of the resource in the long run. The management plans could:

- Limit the number of vessels in the fishery
- Determine convenient the type of vessel and its GRT and kW in accord to the type of fishery.
- Establish the fishing schedule and the days when the fishing activity is allowed, plus the days when the fishing activity is prohibited.
- Limit and define the number and characteristics of the gears used in the fishery.
- The setting of conservation, protection and recuperation measures.

The conservation, protection and recuperation measures are also indicated in the title II. The title 6 defines the conservation measures that can be used as:

- Establishment of minimum sizes for the species targeted by the fishing fleet.
- Establishment of closed seasons or fishing bans, especially for the species with commercial interest.
- Fishing prohibition of threatened species
- Establishment of a VCL or a TAC for species, Zones, stocks or periods.

Additional measures as setting of prohibited fishing zones (article 7), MPAs (article 9) and Fishery Reserves (article10).
The Order of the 24th of June 2011 has included mostly all the elements pointed out by the article 13 additionally to part of the ones pointed out by the article 6 and 7. The Fishery Reserve of the Guadalquivir will obviously enter in the definition of the article 10.

Co-management Structure

Through Title VI, article 41 of the Law 1/2002 the JJAA recognise the role of the cofradías in the management of the fishery by defining their role and the duties that can be assigned or are assigned to them by the Public Administration. Their duties, mostly focused to the artisanal sector (the Striped venus fishery included), are the following ones:

i. Act as consultative organ of the public administration on the elaboration and application of rules that can affect the fishing sector.
ii. Act as consultative organ of the public administration in the elaboration of studies and reports when the public administration asks to.
iii. Present to the public administration proposals in order to improve the fishing sector (or fishery in particular), particularly those proposals that pursue to improve the technical, economic and social conditions of the fishing activity, especially in the artisanal sector.
iv. Act as collaborative organ of the public administration referring to the fishing activity and commercialization of the catch.
v. Promote formation activities related with fisheries for the professionals of the sector
vi. Act as public offices for the reception, the registration and processing of the documentation directed to the CAPDR
vii. Represent and defend the economic and corporative interests of their member

The cofradías involved in the management of the Striped venus Fishery are:

- Cofradía of Sanlúcar de Barrameda
- Cofradía of Punta Umbría
- Cofradía of Isla Cristina
- Cofradía of Ayamonte

Illegal fishing

There is presence of illegal fishing activities in the gulf of Cádiz, and although just a small percentage of the fleet is commonly breaking the law (7-8%; information obtained through personal interview, 2017) it's enough for provoking a closure as in 2010 and 2016. Illegal activities as manipulation and or breaking of the Green Box, fishing activity in the prohibited zones, fishing activity during closed seasons and transfer on sea of part of the catch to small boats (information obtained through personal interview, 2017).

SCORE: 3

4.2.3 Transferability

The Order of the 23rd of September 2008 regulates how the right is transferred. Little control is applied by the government, being the only requirement for the transfer included in the previously cited article 7 of the same order:

- In case of buying a vessel included in the census, it has to be communicated to the CAPDR within the 20 days after the acquisition of the vessel. The owner just has to present a copy

from the Registro Mercantil de Buques (Vessels Company House) and the new address of the owner.

Since the license, and thus the right, is linked to the vessel, the right is not divisible.

Regarding to the ownership, it seems that there is little or inexistent limit on ownership since it is common for one person to own more than one vessel in the same cofradía (information obtained through personal interview, 2017)

SCORE: 3

4.2.4 Exclusivity

Following the flowchart (appendix D, figure 14), and the information previously gathered, we can determine the exclusivity of the right.

The cofradía management system could be considered as a TURF, due to the territorial basis. However, boundaries limiting the fishing zone of each cofradía do not exist, fishing all the cofradías in the same zone (see appendix F). Cooperation and trade-offs between fishers should be in place for an effective management and a sustainable use of the resource when no division of the fishing zone is in place (Poon & Bonzon, 2013); nevertheless, this elements are not always present in the Striped venus fishery. The role of the cofradía will be mostly for: (1) administration of the fleet (2) representation of the fleet.

The right in the fishery is, as previously said, an individual right concede through a fishing license linked to the vessel as has been previously noted.

No TAC has been used in the fishery before the closure of November 2016, and no informal harvest rules have been in place during the period between the Order of 2011 and the closure of 2016.

SCORE: 2

Chapter 5 Discussion

The discussion contains three parts. Firstly, the results of the governance assessment are reviewed and discussed taking into account the effect that the governance attributes analysed are having over the resource Secondly, the results of the property rights´ economic assessment will be discussed contrasting the results of the analysis with the behaviour observed in the fishery. Finally we will contrast the results obtained with the literature reviewed.

5.1 Governance

A significant gap in the governance has been detected due to the absence of an efficient enforcement mechanism which is affecting the attaining of sustainable outcomes. Although the means exist for the CAPDR to monitor and enforce the fishery properly, those mechanisms are not working. The increase of the number of the illegal fishing activities in 2014 and manipulations of the Green Boxes are a clear example of this statement. Plus, even if the illegal fishing activity is commonly carried by a small part of the fleet, the inefficient enforcement produces a waterfall effect that stimulates more non-compliance. The CAPDR is being permissive with non-compliance and cofradías do not self-impose enforcement and monitoring measures, which do not help when managing the fishery.

The lack of social cohesion and capacity of self-organization in the gulf of Cádiz is also affecting to the efficiency of the governance. The actual co-management system is considered flexible and gives to the different actors of the fishery the possibility of being represented participating in the regulatory process and of presenting their own proposals. However, the system is not effective since the cofradías do not have the technical capacity for proposing reasonable measures. Cofradías can self-regulate and take more management responsibilities if the self-imposed measures do not enter into conflict with the regulation in place. But, self-regulation is rare and inexistent in the period studied, except for some punctual attempts in 2013. Cofradías are not prone to propose new rules or even support the ones proposed by other cofradías. Even if numerous meetings are hold within the fishing sector, they do not normally arrive to consensus or to new ways of solving the problems in the fishery. Proposals are only made when the situation is critical (as in the closure of 2016) and there is no to many regulatory options.

Some of the former deficiencies seem to be partially mitigated by other of the governance attributes studied. The strong regulatory authority, clear goals aligned with conservation and sustainability and the science based decision making had allowed to the Autonomous Region of Andalucía to cope with the gaps present in the system. The direct control of the CAPDR and the continuous following of the fishery by the IEO and AGAPA have allowed regulating and adjusting the fishing regulation when new regulations have been needed. This proper response, additionally to reproductive and growth characteristics of the Striped venus, have enable to avoid a worst situation, intervening the CAPDR when the resource has been in danger by closing the fishery or imposing new regulation.

It could be possible that the vessel owners association is also contributing to the lack of cohesion, conflicts and to inefficient governance. Since there are both represented by the

cofradías and the vessels owner association, it is possible that this duplicity is creating inefficiencies in the representation system. However enough information has not be gathered for identify these hypothesis. The role of the vessel owners association need to be further investigated.

Although, all the stakeholders participate in the negotiations and the FACOPE acts as representative of the cofradías for leveling the field, enough information has not been gathered for correctly define the role played by FACOPE.

5.2 Property rights

Regarding to the individual interests, the analysis through property rights´ economic assessment shows that the license system in the fishery of the Striped venus is far away of being close to the perfect property right standard (Figure 15).

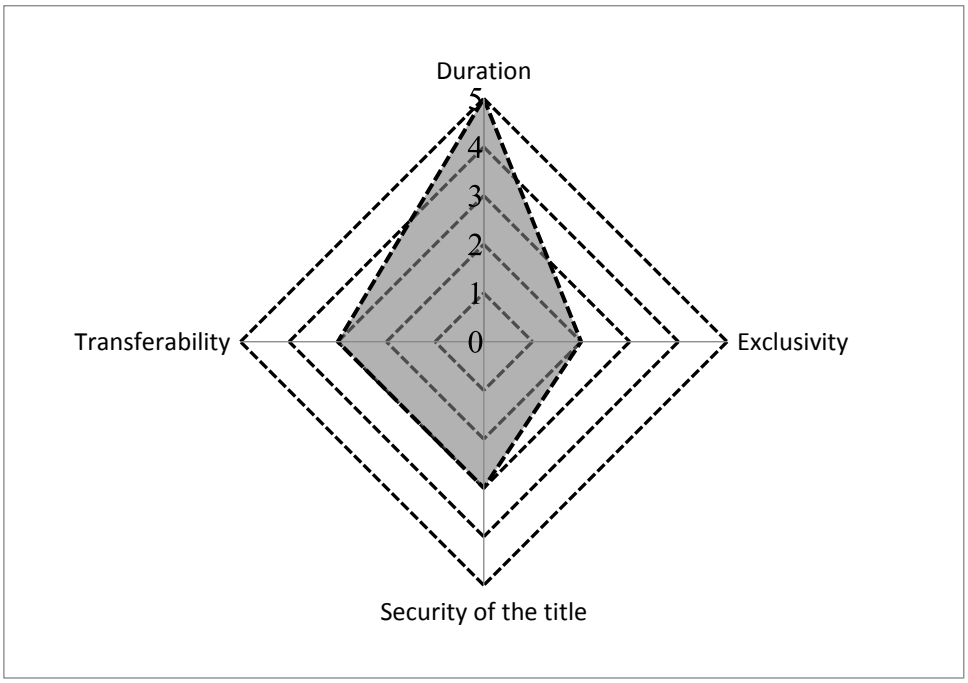

Figure 15: Radar diagram of property rights' economic characteristics of the Striped venus clam fishery.

It could consider that there is a combination of property rights in the fishery with (1) a community right (TURF) and then (2) an allocation of individuals property rights (LL). The combination of both rights should provide better characteristics than the ones shown. However, even if could be considered a TURF, the effect of the territorial right over the individual right is considered inexistent, since considering that no boundaries are limiting fishing zones, collaboration between cofradías should exist and it does not.

When looking closely at the results of the property rights' economic assessment, the highest score was obtained when looking at the duration of the right, being this one permanent. Theoretically, it should stimulate sustainable behaviour of the owner and even the investment for reducing cost, increasing selectivity, increase catchability, etc. However the state of the resource and the number of non-compliance cases suggest a

completely different type of behaviour, which could be caused by other the other characteristics.

The security level, even without having a theoretical low score (3), could be providing a different image to the fishers, being the real security perceived lower than theoretically should. As previously described, the right is not usually efficiently enforced. The government is transparent but the measures, even if agreed by the fishing sector, seem more an imposition than a negotiation. Actually this could not be in other way, mostly because of the passivity of the fishers, which provides an inefficient co-management.

The lowest score is obtained when analyzing exclusivity. Low exclusivity over the resource, where not even informal catch limit or spatial boundaries exists and where illegal fishing is common, has provoked an increase of the illegal fishing activities, the increase of the real fishing effort and the consequent overharvest.

We consider here that the transferability, even with a medium score, do not have any effect in the behaviour of the fishermen and on the possibilities that can offer to the fishery since the right is ligated to a vessel, being then the right non divisible.

It has to be pointed out that the analysis and evaluation of the characteristics of the property right and its impacts over individual interests and behavior are theoretical and are based on observations, bibliographical review and interviews with members of the IEO, AGAPA, JJAA and the Cofradía of Sanlúcar de Barrameda. An empirical analysis through questionnaire could be useful for finding out the real perception of these characteristics by the fisher and for confirming or rejecting the theoretical hypothesis.

5.3 Previous studies

The results of the thesis support the conclusions of Alegret about the cofradía system in Spain and Catalonia (1999a, 2009) and its change since the 80´s. The cofradías have a lack of capacity to create any real internal discussion and they approach general problems from a strictly local point of view (each port, each cofradía), thinking and acting locally instead of globally. The fact that the cofradías do not have bargaining process due to the fact that they only do proposals when the situation is critical there is no many regulatory options has been also pointed by him.

Also, the results suggest that the cofradía co-management system in the gulf of Cádiz do not gather some of the elements identified by other authors as common for a successful co-management of the resource as (1) lack of well-defined boundaries (Pomeroy, 2001; Jentoft, 2009), (2) the lack of social cohesion due to the atomization of the fishing community when managing a common resource (Pomeroy, 2001; Gutierrez et al. 2011; Crona et al., 2016) and (3) the lack of proper enforcement(Pomeroy 2001; Gutierrez, et al. 2011; Crona et al., 2016).

The effect of the social cohesion over other elements of governance shows that as found by Battista et al. (2016), the relationship between several attributes (in that case the social cohesion) is more important that the single studies of governance attributes.

Contrary to Franquesa (2004) and in line with Alegret (1998), the initial idea of the Cofradías system being a proper TURF has been criticized and its efficiency undervalued. The fishing area of each cofradía is not well defined fishing all the vessels in the same fishing zone, while being the fleets from 4 different cofradías and 5 ports. Each cofradía is independent and has been previously seen, there is lack of cohesion which leads to management inefficiencies.

Chapter 6 Conclusion and Recommendations

After analysing the coastal governance system and the property rights of the Striped venus fishery, some conclusion can be drawn.

First and foremost, different fleets from different cofradías fish the same resource and in the same zone, however, little self-organization and self-regulation exist in the fishery due to the lack of cohesion between cofradías. Clear rules within the fleets targeting Striped venus about who can fish, where and how are missed (there is no clear boundaries or self-imposed catch limits) and, taking into account the difficult cooperation and lack of consensus between cofradías, this rules are unlikely to appear. This makes the actual individual license system poorly exclusive (closer to open access). The increase of fishing effort and the increase of the number on non-compliance cases are a clear example of the race for fish in the fishery.

Moreover, when talking about non-compliance, it is evident that the lack of efficient enforcement mechanisms does not help in solving the situation. The enforcement mechanisms of the JJAA have proven to be ineffective, and the cofradías do not control the behaviour of their fleets. Taking into account that the effort limits on the regulation have been imposed estimating the maximum effort for the fishery to be sustainable, the high number of non-compliance cases makes the regulation also inefficient (even if based in scientific information).

Last but not least, the lack of cohesion and the inefficient enforcement mechanism could lead the fishermen to perceive the right insecure, being more likely for the fishers to not behave in accord with the sustainability of the stock, whether it be by participating in the management or acting sustainably.

In conclusion, the coastal governance and the rights present in the fishery are not contributing to the sustainability of the Striped venus fishery. The coastal governance presents problems that should be solved as the high number of cofradías accessing the same resource and the lack of effective enforcement. Since no real co-management is in place and cofradías are not playing their role efficiently, it is unlikely that any measure, including the TAC approved in 2017, is going to work in the future efficiently.

The reduction of the number of cofradías or the union of the existing ones could reduce the cohesion problems and maybe stimulate a better management. The division of the fishing zone creating real TURFs by cofradías could be also an option for increasing the exclusivity of the right, since each cofradía will have exclusive access and management duties over a portion of the resource, not over all of it.

Although the sharing of the TAC is a competence of the cofradías, the JJAA could establish an IQ (transferable or not) for solving exclusivity problems. In fact this measure could allow solving the problem of the lack of regulation about the effort of the manual dredge over the resource, defining better the part of Striped venus that they can catch.

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Appendix

Appendix A: People consulted for the analysis

- **Alejandro Terrón Sigler**, AGAPA. Coordinator of the fishing resources of Andalucía. Interviewed by email on March 9th, 2017 and by phone on March 23rd, 2017 email personal communication, March 23, 2017

- **Jorge L. Campos Uclés**, Secretary of FACOPE, Interviewed by phone August 11, 2017

- **José Carlos Macías**, cofradía of Sanlúcar de Barrameda. Technician of the cofradía Interviewed by email on August 17th, 2017 and by phone on August 18th, 2017.

- **Marina Delgado**, IEO - Cádiz. Researcher involved in the biological monitoring project of the Striped venus in the Gulf of Cádiz. Interviewed by phone 16 August, 2017

- **Rodrigo Sánchez Haro**, CAPDR. Andalusian Minister of Agriculture, Fisheries and Rural Development. Interviewed by email on July 31st, 2017

Appendix B: Questions used to guide interviews

Since each interviewee has a different role in the fishery and the objective was to obtain the maximum information about the relation between stakeholders and the coastal governance, all the questions were somewhat free form, such that if an interviewee had more to say about one topic than another he or she was allowed to guide the conversation.

However, all of the below questions where addressed at least briefly with each interviewee.

1. What is your role in the management of the Striped venus fishery?

2. Who monitors the state of the resource and how is it done?

3. Who takes the decisions when the management plan is created and what is the elaboration process?

4. Who is in charge of the enforcement of the Striped venus fishery?

5. Are the actual enforcement mechanisms and monitoring resources enough for ensuring compliance in the chiral fishery?

6. Does the JJAA take into account the dependence of the fishing sector over the resource account when regulating the fishing activity?

7. Does the JJAA stimulate the participation of the fishers in the management of the fishery? How does the fishing sector participate in the management of the fishery?

8. If the sector has proposed management measures, which measures has proposed? Are the proposals reasonable?

9. Taking into account the evolution of the fishery, do you consider that regulations included in the actual management plan have been the correct ones?

10. How does the government proceed for taking the management decisions and for establishing the objectives? Are the objectives clear and well defined? Are all the stakeholders of the fishery involved in the establishment of the management objectives and principles?

11. Is the management fully transparent? Is there enough communication between fishers and government for them to know what is happening?

12. What do you think about the relation between the cofradías? Do they have any type of agreement for sharing the resource? In case of establishing TAC, do you think that they would share the Total Allowable Catch in an equitable way?

13. What do you think about the capacity of self-regulation and self-organization of the cofradías?

14. Is it recognised the right of the sector for managing the resource or is an exclusive duty of the JJAA?

15. Does the JJAA give specific responsibilities to the sector referring to their right of use the resource?

16. When talking about the licenses of the fishery of the Striped venus, would the fleet be increased in the future?

17. Is the sector aware of the importance of the sustainable use of the resource? Which role does the administration have regarding to the awareness of the sector.

Appendix C: Master list of effective governance attributes and definitions

The following table (Table 7) includes all the attributes that EDF has compiled as necessary for good conservation outcomes.

Table 7: Master list of effective governance attributes and definitions

	Attribute	Amended definition
Structural attributes	Regulatory authority	_ The authority (granted by statute) to develop, adopt, and implement rules and regulations within a given management jurisdiction or over a particular resource or set of resources, evaluate the efficacy of those decisions, and adjust them over time.
	Efficient enforcement mechanisms	_ Mechanisms to enforce compliance with rules should be available to those tasked with monitoring those rules. _ Sanctions should increase with repeat offenses and in congruence to the severity of the offences.
	Governance goals aligned with conservation objectives	_ Ecosystem values are identified, including ecosystem connections, conservation status, state of ecosystem integrity and critical habitat for utilized and non-utilized species. _ Rules are developed that limit resource use, with a focus on maintaining the natural structure and function of the ecosystem.
	Science-based decision making	_ Decision-making under established policy must be based on the best available science. _ Where significant scientific uncertainty exists, the precautionary principle should guide decision-making. _ Local knowledge should be integrated _ All sources of understanding need to be mobilized- management may benefit from the combination of different knowledge systems. _ Social incentives for ecological knowledge generation need to be in place.
	Agency flexibility	_ Institutions should be capable of adapting to new situations in ways that are appropriate to the relevant respects in which the situation has changed. _ Institutions should not change fundamentally when a situational change is not really relevant to the system.
	Explicit recognition of tradeoffs	_ Agencies must have formalized mechanisms to make choices if and when goals or values conflict with each other.
	Dependable funding	_ State (or other legal authority) must guarantee sufficient and dependable funding to the effort. _ Credit opportunities should be provided to local organizations for creation and maintenance of cooperative services. _ Aid should be provided to local users in exchange for conservation services.

	Participation	_ Stakeholder engagement must be institutionalized, incorporated as early as possible, carried out consistently throughout the management and rule-making process. _ Engagement must include rapid dissemination of information, materials, public comments, etc. _ All individuals affected by rules must be able to participate in changing them (collective choice arrangements).
	Systematic representation	_ Relevant stakeholders need to be identified, analysed, and represented systematically. _ Institutions should have formal mechanisms for "leveling the playing field" during negotiations.
	Attribute	Amended definition
Structural attributes	Deliberation	_ A process of open communication, discussion, and reflection among actors who have alternative political viewpoints and understandings should include debate, decent, mediation, and negotiation. Highly skilled facilitation is necessary. _ Conflict resolution mechanisms must exist.
	Clear decision making rules	_ Decision-making rules should be established up front, leaving no ambiguity regarding how decision outcomes will be achieved.
	Clear objectives and directives	_ Management system should set forth overarching principles, clear tasks, deadlines for completing tasks, directives explaining the standards by which decisions will be measured and made, and the processes for making those decisions. _ Objectives should be developed among stakeholders to represent shared vision. _ Objectives and directives should be agreed on at the outset in order to inform participatory process. _ Periodic review should be carried out to determine progress. _ System (biophysical) and institutional boundaries should be clearly defined.
	Accountability and Transparency	_ Managing agents should be accountable to both local communities and higher authorities. _ Mechanisms for transparency and accountability such as independent monitoring, clear milestone deadlines, linking funding with achievement or performance, issuing performance reports for public consumption, polycentricity, separation of powers, legal recourse, budget control, and a free media should be incorporated into all levels of the governance hierarchy. _ Management systems should provide for maximum transparency so that the basis for data analysis and decision-making is unambiguous and the process by which decisions are made is obvious as the decisions are under consideration. _ Management decisions should be publicly defensible. _ Accurate information about the condition of the resource and the expected flow of benefits and costs should be available at low cost. _ Management decisions should be independent of political and/or special interest agendas to reduce the potential for "agency capture" or political gridlock. _ Institutions should be sensitive to the complex (sometimes self-serving) motivations of social actors.

	Appropriate scale	_ Scale of appropriation rules (restricting time, place, technology, and/or quantity of resource available for use) and provision rules (requiring labour) should be congruent with local conditions and scaled to local system. _ Institutional arrangements should be variable across spatial and temporal scales, and should encourage experimentation in different places as well as take lessons learned elsewhere into account.
	Social Justice and empowerment	_ Managing entities should engage in proactive efforts to address inequities in the distribution of rights, benefits, and involuntary risks. _ Institutions must have mechanisms to actually respond to feedback provided during participatory process.
	Attribute	Amended definition
Structural attributes	Organizational features designed to allow transfer of authority	_ Multi-layered (nested) and/or polycentric governance hierarchies must allow for authority to be transferred to different levels to prevent corruption and improve efficiency. _ Institutional relationships/ interactions/ power sharing should be formalized and transparent. Coordination among agencies should be designed to reduce the bureaucratic burden. _ Attributes of larger scale institutions (i.e., federal government agencies) should be designed to facilitate smaller scale, more local institutions to achieve their goals. _ Smaller scale institutions should be designed to foster leadership and social capital.
Societal enabling conditions	Capacity for self-organization	_ Strong local leadership that must be familiar with local traditions and changing external conditions. _ High capacity and self-organization exists to free the system from the need to be continually invested in, subsidized, or replenished from outside. _ Participants should have the autonomy to make many of their own operational rules which if made legitimately, will not be interfered with, and even potentially will be supported and enforced by, external authorities. _ Participants should use collective-choice rules that fall between the extremes of unanimity or control by a few (or by bare majority) and thus avoid high transaction or high deprivation costs. _ Participant groups should be small enough to enable ease of cooperation. _ Users should be located close to the resource. _ User group boundaries should be clearly defined.

	Capacity for adaptation and learning	_ The system is enabled to cope with nonlinearities or other forms of surprise and uncertainty; to detect hard-to-reverse thresholds in a timely manner; and improve fit between rules and ecosystems even as they go through dynamic cycles. _ Participants can develop relatively accurate and low-cost monitoring and sanctioning arrangements. Pre-existing local/traditional organizations. _ Local and traditional organizations should serve as the foundation for more formalized management organizations. _ Participants should share generalized norms of reciprocity and trust, based on past successful experiences in group functioning that can be used as initial social capital. _ Participants must not discount the future at a high rate.
	Social support and agreement	_ Participants should be relatively homogenous in regard to information and preferences about the use of the resource. _ Interdependence should exist among group members. _ Participants must share a common understanding about the potential benefits and risks associated with the continuance of the status quo as contrasted with changes in norms and rules that they could feasibly adopt. _ The group using the resource should be relatively small and stable.

Source: From "a Comprehensive Method for Assessing Marine Resource Governance: Case Study in Kãne'ohe Bay, Hawai'i"by W. Battista et al., 2016, Coastal management, 44,p. 297-299

Appendix D: Exclusivity flowchart

The following flowchart (Figure 16) has been created in order to identify the degree of exclusivity of the fishing right present in the fishery.

It should be noticed that, although informal allocation rules have been recognized, the analyse of CMT rights was avoided since it could be a study by itself. The flowchart will be used for the analyse of regulated fisheries.

Regarding to the scoring, the criteria followed for giving the score was the degree of definition of the access and the likelihood of overlapping of the fishing right.

The maximum score (5), was given to individual TURF and to IQ since the right is perfectly define.

The minimum score (1) is given to the open access, since there is no property right.

The other scores were given taking into account that:

- The establishment TAC or Annual catch limit would help to define better fishing rights, even if they are not allocated through formal allocation mechanisms.
- Informal access/harvest rules could increase the possibility of a better defined right, although is less enforceable due to its informal character.

Regarding to community rights, it was considered that, within the community, individual rights will be granted for fishing, having licenses been included according to this argument. Individual quotas and individual territorial rights do not need to have included a license layer, since they normally are already attached to a license (boats or fishers).

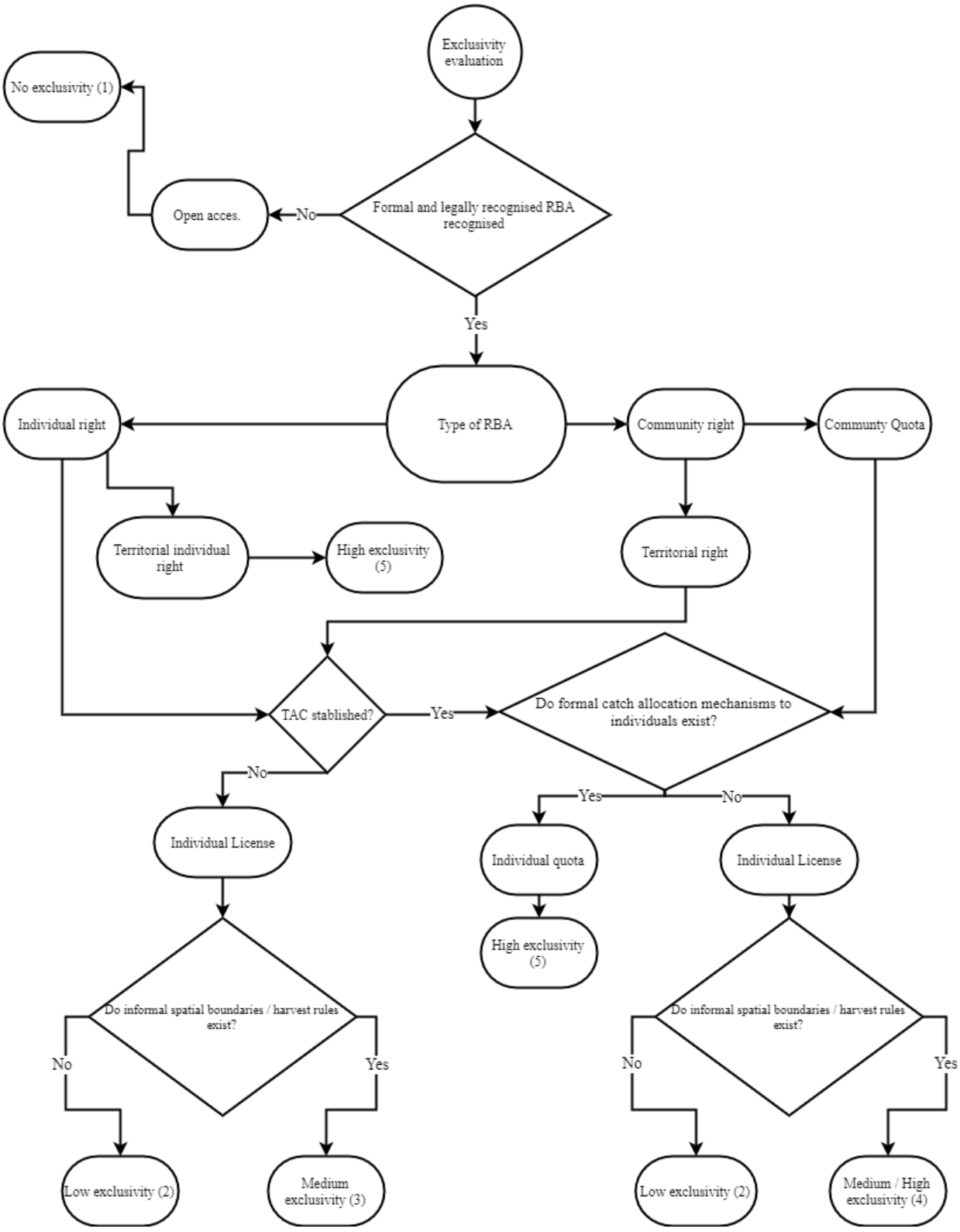

Figure 16: Flowchart for evaluating exclusivity

Appendix E: Evolution of the Fishing Capacity from 2011 to 2016

Table 8: Evolution of the fishing capacity of the fleet from 2011 to 2016

	2011			2016			Variation rate from 2011 to 2016		
Port	No. Vessels	Average GRT	Average power (kW)	No. Vessels	Average GRT	Average power (kW)	No. Vessels	Average GRT	Average power (kW)
AYAMONTE	5	9,17	55,04	2	9,92	69,5	**-60%**	**9%**	**26%**
CHIPIONA	1	8,41	58,87	1	7,47	80	**0%**	**-11%**	**36%**
HUELVA	1	8,93	89,04	1	13,41	121	**0%**	**50%**	**36%**
ISLA CRISTINA	30	12,50	76,33	37	12,14	103,65	**23%**	**-3%**	**36%**
LEPE	7	19,72	118,69	7	14,32	161,29	**0%**	**-27%**	**36%**
PUNTA UMBRIA	34	14,61	84,51	33	13,22	118,21	**-3%**	**-9%**	**40%**
SANLÚCAR DE BARRAMEDA	18	10,89	82,41	15	11,42	112,19	**-17%**	**5%**	**36%**
TOTAL	96	12,02	80,70	96	12,48	111,97	**0%**	**4%**	**39%**

Source: Data of 2016 from Cortés Rodríguez, C. (2016). La técnica multicriterio de programación por metas en la gestión de la pesquería de chirla ("Chamelea gallina") de la región suratlántica Española. Data of 2011 from the Order of the 24th of June 2011 (BOJA No. 128, 1st July 2011).

Appendix F: Fishing zones in the Gulf of Cádiz

It has to be noticed that there is no ore 6 months closures in the zone C, which coincide with the zone D or the Fihing Reserve of the Guadalquivir.

Figure 17: Fishing Zone of Striped venus. *Huelva Información* (http://www.huelvainformacion.es/provincia/estudio-caladero-chirla-entredicho_0_434357285.html)

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CIHEAM

El Máster Internacional en GESTIÓN PESQUERA SOSTENIBLE está organizado conjuntamente por la Universidad de Alicante (UA), el Ministerio de Agricultura, Alimentación y Medio Ambiente (MAGRAMA), a través de la Secretaría General de Pesca (SGP), y el Centro Internacional de Altos Estudios Agronómicos Mediterráneos (CIHEAM), a través del Instituto Agronómico Mediterráneo de Zaragoza (IAMZ).

El Máster se desarrolla a tiempo completo en dos años académicos. Tras completar el primer año (programa basado en clases lectivas, prácticas, trabajos tutorados, seminarios abiertos y visitas técnicas), durante la segunda parte los participantes dedican 10 meses a la iniciación a la investigación o a la actividad profesional realizando un trabajo de investigación original a través de la elaboración de la Tesis Master of Science. El presente manuscrito es el resultado de uno de estos trabajos y ha sido aprobado en lectura pública ante un jurado de calificación.

The International Master in SUSTAINABLE FISHERIES MANAGEMENT is jointly organized by the University of Alicante (UA), the Spanish Ministry of Agriculture, Food and Environment (MAGRAMA), through the General Secretariat of Fisheries (SGP), and the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (IAMZ),

The Master is developed over two academic years. Upon completion of the first year (a programme based on lectures, practicals, supervised work, seminars and technical visits), during the second part the participants devote a period of 10 months to initiation to research or to professional activities conducting an original research work through the elaboration of the Master Thesis. The present manuscript is the result of one of these works and has been defended before an examination board.